

**ASSISTED REPRODUCTIVE TECHNOLOGIES, NETWORKS, AND
AGENCY: A SOCIOLOGICAL STUDY IN HYDERABAD**

*A thesis submitted during 2023 to the University of Hyderabad in partial
fulfillment of the award of*

**DOCTOR OF PHILOSOPHY
IN
SOCIOLOGY**

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DECLARATION

I, **Arosmita Sahoo**, hereby declare that this thesis entitled “**Assisted Reproductive Technologies, Networks, and Agency: A Sociological Study in Hyderabad.**” submitted by me under the guidance and supervision of Prof. C. Raghava Reddy is a bonafide research work. I also declare that this thesis has not been submitted previously in part or full to this University or any other University or Institution for the award of any degree or diploma.

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CERTIFICATE

This is to certify that the thesis entitled “**Assisted Reproductive Technologies, Networks, and Agency: A Sociological Study in Hyderabad.**” submitted by Ms. Arosmitta Sahoo bearing Registration Number 15SSPH08 in partial fulfillment of the requirements for the award of Doctor of Philosophy in Sociology, School of Social Sciences is a bonafide work carried out by her under my supervision and guidance.

This thesis is free from Plagiarism and has not been submitted previously in part or in full to this or any other University or Institution for award of any degree or diploma.

Further, the student has the following publications

1. Sahoo, A. and Reddy, C. R. (2023) Impact of Population Policies on Women’s Reproductive Rights in India: A Sociological Analysis. *Explorations; E-journal of the Indian Sociological Society*, 7(1) 70-89.

She has made presentations in the following conferences

1. Presented a paper titled “Legitimizing Reproductive Rights, and its Implication on Women” at the international conference Maternal & Child Health in Empowered Action Group States: Sustainable Development Goals Perspective, organized by A N Sinha Institute of Social Studies, Patna, in collaboration with UNICEF, Bihar & Tata-Cornell Institute, USA held from 5th-6th April, 2019.
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Further, the student was exempted from doing coursework (recommended by Doctoral Committee) on the basis of the following courses passed during her M.Phil. Program and the M.Phil. Degree was awarded:

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ABBREVIATIONS

AMH	Anti-mullerian Hormone
ANT	Actor Network Theory
ARTs	Assisted Reproductive Technologies
CARA	Central Adoption Resource Authority
CEO	Chief executive officer
CSE	Centre for Science and Environment
DNA	Deoxyribonucleic acid
ERA	Endometrial Receptivity Array
FET	Frozen Embryo Transfer
FINRRAGE	Feminist International Network of Resistance to Reproductive and Genetic Engineering
FOGSI	Gynaecological Societies of India
GHMC	Greater Hyderabad Municipal Corporation
GIFT	Gamete Intrafallopian Transfer
ICMART	International Committee for Monitoring Assisted Reproductive Technologies
ICMR	Indian Council of Medical Research
ICSI	Intracytoplasmic sperm injection
IEC	Institutional Ethical Committee
IFFS	International Federation of Fertility Societies
IMA	Indian Medical Association
ISAR	Indian Society of Assistant Reproduction
IT	Information Technology
IUI	Intrauterine insemination
IVF	In vitro fertilisation
LGBTQ+	Lesbian, gay, bisexual, transgender and queer or questioning
MACS	Magnetic-Activated Cell Sorting
MBA	Master of Business Administration

MNC	Multinational Corporation
NARI	National ART Registry of India
NGOs	Non-government Organisations
NICU	Neonatal Intensive Care Unit
NRTs	New Reproductive Technologies
OBC	Other Backward Classes
PGD	Preimplantation Genetic Diagnosis
PGS	Preimplantation Genetic Screening
PGT-A	Preimplantation Genetic testing for Aneuploidy
RTA	Reflective Thematic Analysis
SC	Schedule Caste
SCNT	Somatic Cell Nucleus Transfer
SSK	Sociology of Scientific Knowledge
SST	Social Shaping of Technology
STS	Science and Technology Studies
TA	Thematic Analysis
UG	Undergraduate

CHAPTER ONE

INTRODUCTION

Technological advances in recent decades have significantly impacted society, changing how people live, work, and interact with each other. In the field of reproductive technology, *in vitro fertilisation* (IVF), an essential type of assisted reproductive technologies (ARTs hereafter), is crucial for helping couples overcome infertility. This technological breakthrough took place in human reproduction, allowing babies to be conceived outside a woman's womb. Although there is a long history of the inception and development of artificial insemination and assisted reproductive technologies, IVF technology became visible in the 1970s.¹

Louise Brown, world's first test-tube baby was born in 1978 with the effort of two British researchers, biologist Robert Edwards and gynaecologist Patrick Steptoe. Initially, IVF was questioned for deontological, economic, religious, and political reasons (Seguin, 2001). Eventually, IVF was approved by states worldwide, including the United State, UK, and Australia, with some restrictions for infertility treatment (Ethics et al., 1979); Department of Health and Social Security, 1984; Committee Considered the Social, Ethical and Legal Issues Arising from In Vitro Fertilization, 1982 (mentioned in Leeton & Harman, 1987).

The practice of ARTs in India dates back to the birth of Durga Aggarwal in Kolkota (1978), the world's second successful test-tube baby, just a few months after the birth of Louise Brown. Although the development and use of IVF technology in India was parallel to the British researchers' efforts, it failed to get its credit and 'scientific credibility' for a long due to the unavailability of scientifically produced documents (Latour et al., 1979). The losing battle of Dr. Mukherji, a controversial 'maverick' of India in reproductive medicine and reproductive technology innovation, highlights the 'new global normative order' (Bharadwaj, 2016). The new global normative order certifies Europe as the 'crucible of breakthrough innovation' and has obfuscated the actual flow of scientific ideas in other parts of the geopolitical landscape (ibid).

India claimed its first scientifically credible IVF child baby, Harsh, in 1986 by Dr Indira Hinduja. India thus accumulated a generation of struggle in IVF technology to gain credibility. Eventually, IVF practitioners strived to achieve credible rewards and recognition through

¹ The details of the historical origin and development of IVF technology are discussed in chapter three.

media to gain commercial interest and to become part of the growing global capitalist economy. IVF technology in India has taken a long journey, from initiating a public institute to control the population to a multi-billion-dollar commercial industry worldwide (Radwan, 2005; Raman, et al., 2008). The details of the IVF technology's journey from state interest to the interest of the capitalist market are discussed in chapters three and six of the thesis. Like in the West, the use of IVF technology in India has been seen with suspicion and ambiguity in the initial days and later adopted with much hope.

The acceptability of IVF technology in India has been increasing, and the technology has been widely marketed, including on social media platforms. From the beginning of the twentieth century to today, India has been an epicentre of IVF technology practice. International Federation of Fertility Societies (IFFS) study of 2010 says that India has already registered more than 500 IVF clinics, which was much more than what other developed countries like the USA (450-480), Italy (360), Germany (120-121) and China (102-300). Currently, in every city across the country, both metros and tier II cities, there is at least one IVF centre. Over 2.5 million IVF cycles are being performed globally, whereas India performs 2 to 2.5 lakh IVF cycles yearly. By 2021, the fertility industry was expected to earn about \$ 746 million, which may rise to an estimated \$ 1,453 million by 2017, with a potential growth of five to six lakh IVF cycles yearly (Talwar, 2022).

Hyderabad has many IVF centres. There are advertisements on every street and in every public space on IVF facilities. However, it is difficult to estimate the number of IVF centres in the city of Hyderabad accurately due to the 'lack of comprehensive registries and validation mechanisms' (Allan et al., 2019). The same is true for India. Hyderabad city, the IT hub, sees its most famous IVF clinics in the highly demanded area of the Hi-tech city. The IVF centres primarily attract clients from the IT sector, supposedly due to the changing lifestyle of people leading to a high infertility rate. Though there seems to be a constant change in the gender and reproductive roles of women, giving birth remains an epicentre of the institution of family. In both the states of Telangana and Andhra Pradesh, consanguineous marriage is still in practice. This practice validates the importance of family and genetic ties through a natural process of conception and giving birth to family descendants.

Hyderabad, renowned for its blend of contemporary progress and preservation of traditional heritage, provides an ideal setting for the researcher to delve into the 'IVF network.' This network, a result of advanced technoscience, aids couples in realising conventional cultural

gender role expectations while embracing modernity. The details of field sites are discussed in chapter two of this thesis. However, IVF technology worldwide is practised with much uncertainty and is still adopted secretly by many. With ambiguity and acceptability, this technology continued to be discussed among ethical committees, feminists, academic, state, and civil bodies, including the media. Hence, before delving into the current research's specifics, the following section of this chapter explores the diverse discourses and discussions surrounding IVF technology. These dialogues have occurred across various disciplines, involving scholars with differing viewpoints.

Feminist critique of ARTs: Motherhood is quintessentially a Female Subjecthood

Critical engagement with ARTs by social science scholars began in the 1990s when IVF technology was widespread in the West. These studies are closely intertwined with feminist critiques that challenge binary constructs such as culture versus nature, female versus male, and private versus public domains (Ginsburg & Rapp, 1995; Martin, 2001; Sargent & Davis-Floyd, 1997). The critical examination of IVF technology and assisted conception place women at the centre of discourse. This discourse critically explores the feminist critique of assisted reproductive technologies (ARTs) and women's reproductive rights.

Among the earliest and most notable critics of IVF technology were feminist scholars and activists, who questioned its ethical and religious implications, followed by scholars from various disciplines. A central feminist critique of ARTs centres around the notion of 'choice.' These technologies are propagated within a society already marked by inequalities, scarce resources, and competitive individualism. In such a social structure, increasing choices for some often translates to fewer options for many. Eventually, the critique of ARTs challenges the foundational concept of the 'politics of choice' while questioning the dominant institutions that regulate or endorse these technologies, including the scientific and medical communities, the family institution (Ginsburg, & Rapp, 1995, 1991), its entrenched gender divisions of labour (Schurr, 2018), the media (Jasanoff, 1998), and the state and law (Jasanoff et al., 2020).

The feminist examination of ARTs, particularly IVF, began from the second-wave feminist discourse on bodily autonomy and reproductive rights. Many subsequent scholarly discussions on ARTs developed a more nuanced discussion (Franklin, 1995a, 1995b). Despite the emergence of many nuanced feminist approaches to the critiques of ARTs, the earlier feminist writings, such as Simone de Beauvoir's *The Second Sex*, Shulamith Firestone's Marxist feminist

work *The Dialectic of Sex*, and Marge Piercy's novel *Woman on the Edge of Time* continued to be the essential piece of work in the critiques of ARTs. These early feminist works, especially Firestones,' continued to influence the work of later feminist scholars like Donna Haraway's 'cyborg feminism' (mentioned in Halbert, 2004). Donna Haraway, including Marge Piercy and Barbara Katz Rothman, envisaged and provided a supportive platform for women employing technology, including ARTs (Rothman, 1989; Piercy, 2016; Haraway 1990, 1995).

Simone de Beauvoir, the French existentialist philosopher and a feminist, challenged the notion of motherhood, which is biologically predetermined rather than socially constructed according to her. Her influential work "The Second Sex" (1953) contended that women are conditioned to believe that marriage and motherhood define their womanhood. She asserted that these roles confined women, making it difficult for them to transcend their traditional spheres. According to de Beauvoir (1953), the emphasis should shift towards liberating women from reproductive obligations, encouraging their greater involvement in economic production to attain agency and empowerment.

Shulamith Firestone (1970) advocated for a complete reconstruction of society and proposed overturning conventional ideas about motherhood and gender division of labour, thereby dismantling reproductive expectations. Her groundbreaking work "The Dialectic of Sex" (1970) extended a Marxist lens to explore the interplay between motherhood and women's subordinate status. Firestone highlighted the inconspicuous yet profound influence of sex-based class divisions, which could appear as a superficial disparity or be misconstrued as a matter resolved through mere reforms or the integration of women into the workforce. Firestone critiqued the oversight of the Marxist viewpoint, arguing that it disregarded the underlying sexual dynamics within historical dialectics, favouring economic concerns. She posited that patriarchy had biological roots, attributing male dominance to the concept of the "biological family," which inherently created women's and children's dependence on men. Firestone speculated that reproductive technology could potentially liberate women from reproduction roles. She contended that genuine change for women would only transpire if natural reproduction remained the norm and assisted reproduction became the exception. Her stance endorsed that women must seize/overcome the means of reproduction to eliminate what she calls 'sex class' and break the 'tyranny of the biological family.' She contended the biological reproductive role and envisioned artificial reproduction. In the book "The Dialectic of Sex", Firestone said that reproduction of the species by one sex would be replaced by

artificial reproduction for the benefit of both. Firestone argued that gender will be transcended when technologies are used appropriately. She further contends that technology is the 'realisation of the conceivable in the actual' (Firestone, 1970, p. 162).

Marge Piercy's writing entitled, *Woman on the Edge of Time* (1976) envisioned a future where technology had entirely replaced conventional procreation and conception, eliminating the biological bond between parents and offspring. However, the optimistic visions of both Piercy and Firestone transformed within the feminist critique of ARTs during the 1980s. Feminist perspectives took a radical turn, perceiving technology as inherently imbued with patriarchal and capitalist attributes. This shift in viewpoint reflected a critical stance that characterised ARTs as manifestations of power structures favouring male dominance and economic interests. The feminist movement started to grow in 1970s with the development of the feminist organisation known as the *Feminist International Network of Resistance to Reproductive and Genetic Engineering* (FINRRAGE), which took a radical stand.

A Radical Rejection of ARTs: Politics of Choice

The FINRRAGE movement coalesced as a loosely connected network encompassing individual activists, scholars, and organisations spanning thirty-seven countries across six continents during its active phase from 1984 to 1997. The crux of the feminist critique from the Western perspective revolved around the pro-natal inclinations of the state, critiquing the imposition of patriarchy, capitalism, and state control on women's bodies. In tandem, it scrutinised the anti-natal policies of the global south, particularly countries like India and Bangladesh. The central goal was to raise awareness among women in third-world nations about the effects of contraceptive technologies, often imposed on economically disadvantaged bodies, primarily women's bodies. This critique later expanded its focus to encompass the repercussions of commercialisation within ARTs, specifically IVF technology, and the transnational commercial surrogacy practices prevalent in developing nations. Two key objectives underpinned the movement. Firstly, it sought collective evidence from women of diverse backgrounds in colour, class, nationality, and race to substantiate its claims and establish objectivity. Secondly, it aimed to amplify women's voices at the margins, contributing to a discourse surrounding New Reproductive Technologies (NRTs) with more significant implications for the establishment of 'transnational feminism' (Gupta, 2006). The fundamental purpose was to educate women from technologically advanced and third-world countries about the implications of these technologies. The argument was that reproductive technologies were

initially developed by male scientists who held sway over the scientific laboratories. They intended to dominate and control women's bodies. Conversely, the medical and scientific communities attempted to legitimise these technologies by asserting that they granted women more control over their bodies.

The FINRRAGE movement vehemently challenged the liberal view on ARTs, which the larger scientific communities asserted to legitimise this technology. This Feminist participants in the FINRRAGE movement contended that when 'choice' is entwined with pre-existing social pressures, women are effectively treated as "living laboratories," leading to their gradual detachment from the procreation process instead of empowering them. Despite this, the movement strived to strike a balanced stance by supporting the use of ARTs by women experiencing involuntary infertility. Their resistance extended primarily to the power dynamics wielded by "male techno-docs" seeking to exert control over women's bodies. The movement also raised eugenics concerns, pondering whether the future offspring produced by these New Reproductive Technologies (NRTs) would be predominantly white, middle-class, and heterosexual (Klein, R.1985).

In the initial period of the development of FINRRAGE, few members have given a radical assertion about these new reproductive technologies. They have challenged the speculative ideals of early feminist writers, such as Beauvoir's optimistic views on technology as liberating. Despite few liberal voices with FINRRAGE, radical scholarly writings are like the inaugural publication titled *Test-Tube Women: What Future for Motherhood?* edited by feminist scientists , Renate Duelli Klein, Rita Arditti, and Shelley Minden in 1984 within the FINRRAGE platform expressed resistance to these technologies (mentioned in Arditti, Klein, & Minden, 1984). These authors believed that male-dominated technologies aimed to establish a new form of biological subordination of women. In the book *Mother Machine: From Artificial Insemination to Artificial Wombs* (1985), Gena Corea expressed unease regarding the technological dominance over women's bodies and minds. She delved into the social power dynamics influencing medical technological advancements. Corea contended that these reproductive technologies were inherently oppressive and patriarchal, subjugating women while controlling their reproductive capacity. She condemned the use of ARTs and advocated for resistance from the collective category of 'women,' emphasising its homogeneity.

Within this discourse, Marxist feminist scholar Maria Mies (1993) asserted that reproduction is an inherently natural process ingrained over generations. Childbearing, a quintessential facet

of this process, clashes with the essence of reproductive technology, which diverges from the natural course. Employing a post-colonial standpoint, Mies illuminated how reproductive technologies wrench childbearing away from the womb, crafting a fetus that aligns with the demands of a capitalist society. This selection process is often overseen by male engineers, underscoring male dominance over the organic female process and the detachment of the womb, perpetuating women's oppression (Mies, 1993). Proponents of reproductive technology advocate that it empowers infertile couples to conceive a child from their 'own' flesh and blood. Mies rejected the notion that reproductive technology enhances women's agency and grants them reproductive autonomy. Instead, she contended that reproductive technology leaves women susceptible to various forms of gender-based crimes, rendering them more vulnerable and reliant on external factors.

Furthermore, it erodes their bodily integrity, reducing their entirety to commodifiable and dispensable fragments. Mies cited a significant moment, the 1985 congress in Bonn titled "Women against Reproductive and Genetic Engineering," where participants concluded that New Reproductive Technologies (NRTs) were not designed to aid infertile individuals. Instead, they aimed to foster a novel reproduction industry, addressing industrial capitalism's "growth" predicaments. As conventional growth sectors like steel and coal faced stagnation or decline, the female body's generative capacity was unearthed as a fresh "new investment area" (Mies, 1988, p. 225).

Applying a 'feminist standpoint' perspective, radical feminist Klein (1989) offered a critical assessment of IVF technology, contending that it emerges from a foundation of 'patriarchal science and medicine.' Her argument revolves around the notion that the patriarchal environment within which IVF technology was conceived and practised inherently contradicts women's needs and interests. Patriarchy inherently makes IVF technology 'antithetical' to women's concerns, rendering it fundamentally patriarchal. Klein's stance asserts that societal pressures rooted in patriarchy to conform to motherhood ideals and the social stigma attached to infertility contribute to women opting for IVF technology (Klein, 1989, P. 6). This perspective seemingly discounts women's capacity for agency in fertility matters, reproductive decisions, and the choices on their 'own bodies.' Consequently, Klein advocates complete resistance against ARTs fuelled by global feminist awareness. Amid this discourse, Klein also draws attention to the evolving dynamics in reproductive domains, particularly the shifting understanding of genetic ties between mothers and children within American society.

Barbara Katz Rothman (1993) marked a significant milestone with the release of her pioneering academic work titled "The Tentative Pregnancy: Prenatal Diagnosis and the Future of Motherhood." This book delves into amniocentesis and provides a supportive argument that could foster a more supportive atmosphere for women engaging with such technologies. Rothman's central argument revolves around the idea that science and technology are exacerbating and even coercing choices through new reproductive technologies. According to Rothman, these innovations introduce a novel form of patriarchy into the equation, where 'pregnancy remains quintessentially a female experience' (Rothman, 1989). Her subsequent book *Recreating Motherhood Ideology and Technology in American Society: Beyond Baby M* (1990) offers a nuanced exploration of the term 'reproduction' which she defines as the transformation of raw material into a product. In her view, creating babies is akin to a form of production. This work also delves into the patriarchal kinship structure where women bear and give birth to the offspring of men.

In 1987, the director of a California sperm bank described sperm as the seeds of future individuals. However, this perspective has since evolved. Modern scientists now recognise the significance of the egg in terms of genetic transfer to the child. Consequently, in Western patriarchal systems, women hold comparable rights to men regarding their children. Contemporary technology can replace breastfeeding with formula milk, shift from natural birth to caesarean deliveries, and care for premature babies in neonatal intensive care units for optimal development. Rothman (1989) emphasises the seed's intrinsic value and the advantages and drawbacks of the human womb in contrast to artificial or animal wombs. She goes beyond viewing a woman as a mere physical incubator and underscores the profound physical and emotional connection between a mother and her baby. This perspective prompts contemplation on surrogacy, questioning the potential erosion of social and emotional ties between a child and their birth mother. Rothman's arguments extend to health-related concerns faced by mothers in American society due to cultural factors. The synchronisation between a child and mother during nine months of gestation is disrupted as the child transitions from the womb. In the United States, newborns often spend their initial days in a hospital environment before being placed in separate beds at home, contributing to maternal sleep deprivation. Through her work, Rothman articulates reasons against embracing ARTs, which could potentially sever the social and emotional bonds between a mother and her child. She also underscores the intricate relationship between sleep and the mother-child connection, underscoring how societal norms can interfere with these crucial early interactions.

Adrienne Rich's book "Of Woman Born: Motherhood as Experience and Institution" (1976) delves into the concept of motherhood as an institution that has been distorted and controlled to suit men's interests. She argues that this institutionalisation primarily benefits men, who, driven by cultural dominance, have deprived women of an authentic experience of motherhood due to their apprehension of women's procreative power.

Discussing the patriarchal dimension of ARTs, Rowland (1985) asserts that men have crafted these technologies to exploit women's bodies as 'living laboratories' to further the careers of male medical professionals. Adopting a feminist standpoint approach, Rowland underscores that for women in less empowered positions, especially those in third-world countries relative to white, middle-class Western women, the notion of 'choice' or 'reproductive choice' might hold little relevance or might even signify a lack of choice altogether (Rowland, 1985, 1987). She also critiques the false assurances and uncertainties surrounding the success rates of technologies like IVF. Drawing on O'Brien's theories of reproduction,' Rowland emphasises that ARTs reflect a patriarchal system wherein men claim authority over the creation process due to their perceived alienation from reproduction and creation. Arts, she asserts, are products of men's "womb envy," indicative of their unease and insecurity toward nature owing to their limited role in reproduction (Rowland, 1992, p.9). Her primary concerns orbit around the theme of 'male control of reproductive technologies and its inevitable connection to genetic engineering, eugenics, and issues of choice and control' (Rowland, 1987, p. 513). Rowland (1992) contends that men have designed, developed, and employed ARTs to assuage their womb envy and reconcile their alienation from nature.

The collective classification of feminism within FINRRAGE rendered the discourse vulnerable by entirely rejecting science and technology. This stance hindered the discourse's capacity to engage with the broader 'knowledge production associated with science and technology' (Harding, 1991, 2009). The uncompromising rejection of ARTs invited criticism from feminist scholars and other quarters.

Reproductive choice and women's experience: A liberal response to radical rejection of IVF technology

Like many other technological advancements, IVF is a product of the modern era. A central goal of contemporary projects is to exert dominion over the natural world often. The development of IVF, within the context of reproductive technology, has empowered humans

to influence the creation of life, thereby subjecting life's formation to human manipulation. When considering the application of technology in modern times, scholars with a liberal approach support it while concurring on reservations about its unrestrained usage or potential misuse. These feminist perspectives on ARTs and IVF adopt a relatively moderate stance compared to the preceding radical critique that rejects ARTs as a means of women's liberation by divorcing reproduction from its traditional activities. The liberal feminist approaches align with modernity. While maintaining a critical perspective on scientific (Western scientific) rationality, they integrate some aspects of these "modern rational principles" into the core feminist empiricism. Their arguments revolve around the notion that advancements in science and technology offer women greater choices, with the outcomes contingent upon the ethical deployment of these tools.

In 1983, Naomi Pfeffer and Anne Woollett authored a pioneering feminist guide to infertility treatment titled *The Experience of Infertility*. Built upon their personal experiences with infertility and encompassing the stories of other women dealing with comparable struggles, this handbook mirrors their points of view. Drawing inspiration from Adrienne Rich's work, Pfeffer and Woollett (1983) advocate for the reclamation of sexuality and reproduction from male-dominated frameworks and values. They emphasise that the feelings of women experiencing infertility hold more significance than the emotions they are instructed to feel. Naomi Pfeffer expressed scepticism regarding the work of FINRRAGE, contending that it disregarded the hardships faced by infertile women. She noted that these women's voices were absent in the claims by feminist authors associated with FINRRAGE. Pfeffer underlined this absence by asserting that the debate appeared poorly informed from the viewpoint of an infertile woman, lacking insights into the social, medical, and emotional facets of infertility. Pfeffer and Woollett do not perceive IVF as synonymous with patriarchal control. Their focus primarily lies in empowering women to make reproductive choices, while those choices involve distressing procedures, considerable expenses, or yield unsuccessful IVF outcomes. While their approach prioritised women's health and autonomy, gaining attention within feminist academic discourse during the 1980s proved challenging. A more closely aligned perspective emerged in the 1990s with the publication of "Tomorrow's Child: Reproductive Technologies" by Linda Birke, Gail Vines, and Sue Himmelweit. Like Pfeffer and Woollett, Birke et al. in their work provided guided information about infertility, diagnosis, and potential alleviation through NRTs (mentioned in De Saille, 2017).

This work borrowed ideas from Barbara Katz Rothman's pioneering writing on amniocentesis published in the mid-1980s, particularly from her Appendix, which provided "Guidelines for Personal Decision-making." These guidelines assisted women in making choices related to prenatal screenings, helping them navigate the uncertainties associated with what Rothman termed "tentative pregnancy." Rothman's concept of tentative pregnancy signifies the ambiguity arising from increased information and reproductive options, which she foresaw as potentially oppressive and disempowering for women. Rothman accepted the technology; instead, she proposed that it might enable women to negotiate its demands better. Rosalind Petchesky's noteworthy assertion influenced Rothman's insights in her 1980 article "Reproductive Freedom: Beyond a Women's Right to Choose" Petchesky (1980). The later work illustrate reproductive choices of women and power dynamic within reproductive area.

Similarly, Marge Berer, representing the *Women's Global Network for Reproductive Rights*, took issue with FINRRAGE for what she deemed "imperialist dogma." She criticised the lack of supporting evidence and perceived political naivety in their stance (Berer 1985, p. 33, cited in Franklin, 2013). Following the pioneering work of Pfeffer and Woollett, a more sympathetic feminist approach began to emerge, as seen in scholars like Stanworth. This evolving perspective aimed to acknowledge and confront the diverse nature of infertility, which contributes to the stigmatisation faced by both infertile men and women (Stanworth 1987, P. 6). To revisit the early contributions of Stanworth, she employed a 'feminist empiricist' methodology to investigate the intersections of science, technology, and medicine. Stanworth postulated that reproductive technology would redefine the concept of motherhood. She predicted a significant transformation in the role of women in this process, with their significance potentially diminishing. Technological interventions would manipulate eggs and embryos, positioning women as mere components. Stanworth further opined that in the realm of motherhood, roles might shift across different women, or women's roles could become obsolete due to technological advancements.

Furthermore, Stanworth (1987) posits that the implications of IVF are contingent upon the societal context in which it is applied. She contends that IVF presents a choice capable of empowering women from diverse backgrounds to assume control over their reproductive processes. IVF's significance, according to Stanworth, extends particularly to white, middle-class (relative to income), heterosexual, infertile women. Within the framework of the liberal tradition, numerous scholars have championed IVF technology, primarily when its

implementation occurs with the 'informed consent' of women. While endorsing the liberal aspects of this technology, Stanworth expresses reservations about the potential for men to gain control over women's bodies through the advancement of reproductive technology. She emphasises the importance of women's vigilance in selecting this technology for reproduction, ensuring their agency remains intact.

Like Stanworth, Warren (1988) advances a comparable argument, asserting that IVF technology represents a choice for women who view motherhood as their ultimate source of satisfaction or accomplishment. According to Warren, these women are prepared to endure the uncertainty and risks associated with technological interventions on their bodies. In response to radical feminist criticisms that patriarchal power dynamics and pro-natalist ideals often shape women's choices, Warren proposes that 'while it is challenging to be entirely free from unjust or inappropriate societal and economic pressures, there are instances where we can make well-informed and suitable decisions given our circumstances' (Warren, 1988, p. 41).

While initially aiming to spotlight women's encounters with ARTs, the studies mentioned above inadvertently became more entwined with the feminist discourse surrounding ARTs (Franklin, 2013). Simultaneously, a parallel body of research emerged within FINRRAGE during the mid-1980s, centred on women's experiences with IVF and infertility. This research emerged as a response to the 'hard-line' radical rejection of New Reproductive Technologies (NRTs). Critical members of FINRRAGE, including Christine Crowe (Australia), Lene Koch (Denmark), and Linda Williams (Canada), delved into the motivations behind women's choice to pursue IVF (mentioned in the conference preceding "the International conference Lund-Sweden on International Network New Reproductive Technologies and Genetic Engineering" happened in July 1985).

The internal tension within FINRRAGE, triggered by the radical rejections of NRTs, eventually led to the network's decline starting in 1989. Christine Crowe's article "Women Want It" (1985) examines women's encounters with IVF technology through their personal experiences with the procedure. She investigates how women's perceptions of IVF choices evolve throughout treatment, often yielding outcomes they had not foreseen. Backed by substantial empirical data, Crowe investigates IVF as a technology intricately tied to concepts of kinship, gender roles, marital bonds, and reproduction. Crowe's study reveals that women's decision to opt for IVF is motivated by a desire to affirm their gender identity and strengthen their marital relationship through biological reproduction. However, her findings also suggest

that women undergoing IVF treatment lack awareness of the profoundly unequal circumstances under which they pursue it.

Another FINRRAGE member, the Canadian sociologist Linda Williams (1988), studies the motivations underlying women's persistence in undergoing multiple cycles of IVF despite previous failures. In her article titled "It is Going to Work for Me," Williams identifies the driving force as a "parenthood motivation," elucidating how this factor compels women to undergo IVF repeatedly. This notion of "parenthood motivation" within the IVF procedure was further explored by Gay Becker in 2000, who investigated IVF as a manifestation of consumer culture within the United States. In her study titled "Wanting Children Badly: An Exploratory Study of the Parenthood Motivation of Couples Seeking In Vitro Fertilization," Williams (1989) uncovers that the desire for biological children is intricately connected to personal aspirations and societal pressures.

The research outcomes also indicated a notable trend: wives exhibited a more intense desire for parenthood than their husbands. In most cases, the wives initiated the pursuit of IVF and demonstrated greater enthusiasm for both IVF and persisting through multiple cycles (Williams, 1989). Williams extended her investigations by examining Canadian couples undergoing IVF treatment. Her subsequent studies revealed that the longing for a biological connection between parent and child and limited opportunities for adoption remained significant factors propelling the demand for IVF. While adoption remained a consideration for many, the aspiration for a two-child family motivated the continued pursuit of IVF cycles due to the comparatively lower likelihood of success (Williams, 1990, 1992).

Koch and Morgall (1987) present a feminist evaluation of reproductive technology and propose that the decision to adopt reproductive technologies such as IVF cannot solely rely on feminist principles. They argue that a comprehensive feminist assessment must encompass the intricate "social context of conflicting interests." This context involves many stakeholders, encompassing women, men, technological aspects, healthcare institutions, medical professionals, patients, and economic considerations (Koch et al., 1987, p. 190). According to the perspectives of Koch and Morgall, the choices made by women regarding infertility treatments, specifically in vitro fertilisation (IVF), should not be labelled as irrational. They emphasise that these women's decisions might not align with well-founded warnings against IVF due to the existence of valid and understandable reasons that are not immediately apparent to us. These women inhabit different worlds with distinct norms and rationalise their actions in

ways that differ from our own. Insisting on the dichotomy of "right" or "wrong" viewpoints will not contribute to a better understanding of the complex landscape women navigate in making these decisions. The study brings to light the voices of women seeking infertility treatments, offering insight into their perspectives. Despite the argument by some feminist critics that a fulfilling life does not necessarily require children, Koch and Morgall (1987) assert that such views might not resonate with infertile women who have not yet come to terms with their infertility. For these women, the desire for a child remains significant. Thus, they opt for IVF treatments even in the face of warnings from feminist critics. Lene Koch, a Danish scholar, researched women's experiences with IVF treatments and discovered a recurring theme – the motivation for parenthood. Interestingly, the information about IVF and its implications does not seem to influence the decision-making process of these women heavily, according to Koch's observations.

In another study, Koch (1990) delved into the paradoxical relationship between feminist critiques of IVF and the real-life circumstances of infertile women. She investigated why women undergo multiple IVF cycles despite the associated risks, pain, and previous failures. Koch argues that this choice is not irrational but underpinned by the IVF process's unexpected emotional and physical intensity. She suggests that this choice stems from a form of rationality specific to the IVF protocol's various stages, driven by a desire to shield oneself against the technology's historically high failure rates.

Koch's research highlights the amalgamation of reproductive labour, personal agency, technological promises, and gender identity within the IVF procedure. These factors contribute to what she terms a "different rationality," characterised by a unique sense of timing, utility, emotional orientation, and self-protective mechanisms. Koch advocates for acknowledging these diverse rationalities experienced by women undergoing IVF treatments. She emphasises the importance of comprehending these alternative rationalities to better grasp the reasons behind women's decisions and foster open dialogues that respect their experiences and perspectives.

Sarah Franklin initiated her investigation into IVF technology during the 1980s, driven by an interest in understanding women's encounters with the process of IVF treatment. Throughout her research, she observed a notable transformation in women's perceptions as they underwent the tangible outcomes of IVF procedures (Franklin, 2013). Throughout this journey, women developed a sense of contentment with the consequences of IVF, stemming from their

persistent efforts to realise the dream of bringing a child into their homes. This sentiment was intimately linked with their endurance on both physical and emotional fronts as they traversed the intricacies of the IVF process. Engaging in the treatment held a significant value for these women, symbolising a meaningful attempt at achieving their goals. The women's experience was intricately interwoven with the various stages of IVF, from the retrieval of eggs and their amalgamation with their partner's semen to the nurturing of embryos leading up to the crucial embryo transfer back into the uterus. Franklin's research encompassed the entirety of this journey, irrespective of the eventual outcome, whether successful or otherwise. Capturing this extensive spectrum of emotions and experiences, her 1997 publication "Embodied Progress" offered an insightful account of how women and couples undergoing IVF perceived the process as an integral aspect of their way of life. In Franklin's perspective, IVF provided nature with a supportive hand rather than attempting to supplant it entirely (Franklin, 1997). This characterisation encapsulated her viewpoint on IVF as a technology that augmented natural processes, reflecting her nuanced understanding of the complex interplay between medical intervention and the profound desire for parenthood.

In Denny's research conducted in 1994, the examination revolved around two pivotal dimensions: Pro-Natalism and Power and Control. Denny's (1994) contention rested on the assertion that the perspectives of radical feminists on IVF were predominantly founded on theoretical premises. However, the empirical encounters of women sharply diverged from the viewpoints advocated by radical feminists. The study revealed a contrasting narrative, indicating that women had substantial agency in navigating their choices. Furthermore, these women were actively engaged in making well-informed decisions in the context of IVF.

Lingham (1989, 1998) delves into the discourse surrounding women's reproductive rights. Her perspective accentuates the importance of scrutinising the ethical dimensions linked with the escalating medicalisation of reproduction through technological interventions. Lingham contends that the purported neutrality of value in emerging reproductive technologies, including but not limited to IVF, hormonal implants, sex pre-selection, sex detection, and fetal surgeries, warrants critical examination. She advocates for a conscientious evaluation of the utilisation of such technologies, emphasising the imperative of making informed choices grounded in ethical considerations (Lingham, 1990, 1998, 1998).

Drawing inspiration from Lene Koch's notion of "different rationality," Rapp (1999) conducted an empirical investigation into amniocentesis and explored the geneticization of family life in

all its complexities. Rapp's work on amniocentesis was heavily drawn from her engagement with the same medical procedure. Rapp's perspective contrasts with any inherent issues in medical technologies. Instead, she introduces the term 'moral pioneers' to describe women who opt for technological interventions on their bodies, particularly within amniocentesis. In subsequent work (Rapp, 2011), she expands on this concept of 'moral pioneering.' The later work of Rapp involves women drawing upon their understanding of family dynamics, intrinsic aspirations, and their perceptions of the technology to determine whether to embrace it. Rapp elaborates that this might appear as a constrained choice, but she contends that women exert real agency in these decisions (Rapp, 2011).

Beyond binary: A socio-cultural account of ARTs and IVF technology

The aforementioned academic discourse encompassing ARTs, including IVF and related methodologies, provides a comprehensive analysis of the power dynamics and political rhetoric between those who utilise these technologies and those who provide them. However, this discourse falls short in documenting the aftermath of employing these technologies – specifically, the real-life consequences for the individuals who use them. The conversation tends to overlook the practical implementation of these technologies and how diverse stakeholders interact within the intricate network of IVF, taking into account the inherent technological heterogeneity.

Most importantly, it overlooks addressing the transformative impact of these technologies on the social fabric of users' lives. This void in the discussion prevents an exploration of the operational mechanisms of these technologies within the realm of everyday human existence. The discourse on everyday experiences pertains to individuals' procreative journeys within the context of family, kinship, marriage, and other social dimensions inevitably influenced by human reproduction. The term "social world" is utilised here to describe the intricate interconnectedness of ARTs within the broader fabric of people's lives. With comparable inquiries, subsequent sociology and social anthropology scholars have directed their attention toward ARTs. They approach this subject from various angles, including feminist empirical perspectives, feminist post-modern approaches, and socio-cultural frameworks. This multifaceted exploration aims to shed light on the intricate interplay between technology, society, and individual experiences, thus offering a more holistic understanding of the implications of ARTs on people's lives.

Margarete Sandelowski is the first scholar, a nurse, and an anthropologist who studied infertility and ARTs from a sociological lens, followed by Franklin and others. Sandelowski (1990) used the phrase "false line feminist sisterhood" to present her criticism of the earlier feminist discourse, which, according to her, is a neglected part of the feminist debate about NRTs. She argues that feminist theorising about reproductive technology must avoid socially and biologically deterministic conceptualisation of women, denying them an authentic desire and autonomous choice (Sandelowski, 1990). Later, Sandelowski did an empirical longitudinal study on infertility and new reproductive technologies to understand infertile couples' parenthood transition. This data was collected from 1987 to 1993 and was published in 1993. In her work, Sandelowski argues that the development of advanced ARTs, like IVF with donor insemination facility, has almost eliminated the concept of sterility by offering a curable solution to couples to conceive their biologically related child. This advanced technology, she says, has delayed the starting of the physiological sterility of the perimenopausal period that permits women to conceive and carry children in their 40s and 50s. Regarding access to ARTs, she said that social class predominantly affects the decision of infertile couples to choose the expensive treatment or to leave it. Challenging the earlier debate that keeps women on the centre stage of infertility discourse, Sandelowski (1994) argues that the couple, rather than the individual in general, is perceived as the unit care in infertility practice.

As IVF technology eventually started getting normalised in the market and society, attention shifted towards its study from mere speculation of this technology to its economic and cultural implications. Marilyn Strathern (1990) analysed that in the market economy and late modernity, the 'technological enterprise' turns out the embodied choices their customers make who choose among the embodied choices of those who provide the services (Strathern, 1992 a). Strathern further argues that in this entrepreneurial culture, ART makes individuals a consumer of objects such as gametes and fertilised embryos. The enhancement through technological manipulation and the media's promoter role enhanced a new form of market. Enterprise culture absorbed these medicalised objects in its system, which functions with its participants, i.e., the consumers of these technologies. By using the concept of culture to be how people imagine things, Strathern (1992b) analysed official debates. This debate intended to unfold questions concerning individuality and a person's representation, which is missing in the official debate. Strathern argues that "kinship systems and family structures were imagined as social arrangements not just imitating but based on and deploying process of biological reproduction" (Strathern, 1992b, p. 3). She implies a new reproductive kinship model emerged

in the age of assisted reproductive technologies. In this new model, the traditional yearning for parenthood through biological linkage started being normalised by 'artificial' arrangements, i.e., IVF technology (Strathern, 1992b). Strathern's contribution to how ARTs might denaturalise bridges the nature/culture intersection binary.

Sarah Franklin (1990, 1990a) addresses IVF technology as a 'techno-medical' solution to the infertility problem. As the market expansion of IVF technology increasingly rises with its media proliferation, Franklin started focusing her study on understanding how IVF technology is changing the definition of kinship and infertility per se. She has tried to unravel the complex nuances of the relationship between technology, biology, kinship, commodification, and knowledge. According to Franklin, biology is an authoritative knowledge and a set of phenomena linked to human reproduction. Through the development of IVF technology, these two distinct fields intermingled. As a result, in this biogenetic relationship, biology became visible like never before (Franklin, 2001). Franklin viewed biology and nature as two distinct realms of scientific facts that can no longer be separated in the face of technological reproduction. In this field of technological assistance, the meaning of reproduction, which has been the ground for kinship, is itself reconstructed and redefined. Conception is assisted and achieved by juxtaposing biology, technology, and reproduction. Franklin (1995) writes, "What was once a private act of love, intimacy, and secrecy is now a commercial transaction, public act, and a professionally managed "procedure" and a "successful" conception and pregnancy is an "achievement" (Franklin, 1995, p. 336). With technological progress and the development of IVF technology, kinship's definition no longer remains a fixed category as no fixed part of the biological component remains to be translated into kin relationships. Technology played a pivotal role in crafting relationships, which earlier used to be the fixed part of biological facts. According to Franklin, this newness of kinship and kinship relationship is also temporary and fluid as an unrestrained possibility exists at the focal point of human intervention and medical technologies (Franklin, 1995).

Therefore, studying technology became an essential socio-anthropological tool to understand human reality since they compromised "materialised figuration" (Haraway, 1997, p.97). Haraway understands nature as both a component of humans and non-humans. Scientific knowledge thus induces Euro-American culture by taking control of prospective parents' lives and their identity, individuality, and relationality regarding ancestry and information (Strathern, 1992b). Therefore, the reproduction shift by naturalising kinship creates kinship as

a hybrid institution by interconnecting nature and culture for people in the Euro-American context (Strathern, 1992b). This hybridisation of kinship institutions is accelerated by increasing commodification and technologisation of the realm that was once devoid of human imagination and contact. Marilyn Strathern and Sarah Franklin have addressed the study of the hybridity of kinship, family, and other relationships related to IVF technology and reproduction. They primarily borrowed this hybridity concept from Donna Haraway's hybridity and Bruno Latour's actor-network theory (ANT) (Strathern, 1996 and Franklin, 2001).

Drawing on Latour's network theory, Strathern (1996) explored the "socially expanded hybrids," where "disparate elements are summated in an artefact" (Strathern, 1996, p. 522 & 525). The latter means that under this newness of kinship and in the realm of technologically assisted reproduction, a person's body parts are no longer their own but controlled and owned by someone else (ibid.). Many 'actors play out' in this process, which creates a network. According to Strathern (1996), this network is subjected to a particular time and space frame. How relationships are made and unmade in this network and how kins are created and recreated postulate a hybrid of different realities. Haraway brings this hybridity to her focal point of discussion, and she perceives this hybridity in the space of nature as a cultural practice. It is this space of hybridity where nature becomes cultural. Franklin built her understanding of 'kinship' in IVF, which she believes emerged as "unnatural kinds" (Franklin, 1999, p.114). These "unnaturalised kinds" of relations are naturalised in the everyday practices in infertility clinics (Franklin, 2001, 2006, 2013). According to Franklin, IVF requires normalised and naturalised conformity with conventional gender roles and an acceptance of modern biology to function (ibid.). In other words, IVF demands its users to have "double consciousness" (Adell, 1994; Bartky, 1993; Young, 1990 and Martin, 1987). According to the anthropologist Annemarie Mol (2002), IVF creates "multiple," which produces more than babies.

The research above has introduced a novel perspective to the comprehensive exploration of ARTs, including a focused analysis of IVF technology. Through adopting a post-modern approach to studying ARTs, the scope has evolved beyond a binary assessment of the technology as either advantageous or detrimental. As these technologies progressively integrated into the global economy, becoming integral to economic, cultural, and social landscapes, scholars widened their focus to delve into their multifaceted implications. This extensive inquiry spanned the global north and south, revealing the technology's multifarious impacts within diverse contexts.

ARTs and IVF in the global north

Research on in vitro fertilisation (IVF) technology has primarily centred around its utilisation among middle-class white women and its broader implications within society's political economy (Marken, 2012; Shurr, 2018). Similarly, scholars have examined shifts in kinship systems resulting from these technologies (Franklin, 2006, 2013). While limited in number, some studies have delved into the adoption of ARTs and the emergent global surrogacy market, highlighting the detachment of reproductive labour from commodification (Markens, 2012). The international surrogacy market opened up a global distribution of reproductive labour that intersects with dimensions of gender, race, class, and nationality (Schurr, 2018). This transnational market's rapid growth exposes intricate divisions of labour that are intertwined with economic, cultural, political, and social contexts. Disparities in remuneration between fertility specialists in the Global North and their counterparts in the Global South and East have emerged.

Furthermore, young, educated, white, Western women earn significantly more, sometimes up to a hundredfold, than their peers in countries such as India, Mexico, Ukraine, or Georgia when providing eggs for fertilisation. The accessibility of ARTs exhibits significant inequalities both within and between nation-states. Affluent, urban, heterosexual, married individuals, particularly those of white ethnicity residing in the Global North, tend to have better access to ART compared to marginalised groups, including those who are economically disadvantaged, living in rural areas, identifying as LGBTQ+, non-white, and single, especially in the Global South (Schurr, 2018).

Some researchers have started examining the impact of IVF and related technologies on ethnic minorities and the low-income segments of Western societies. These studies aim to uncover the inequalities in the use of these technologies. However, due to their high costs, access to this technology is unevenly distributed among the population in America. One instance of such research is highlighted by Becker et al. (2006), who explored the issue of infertility among low-resource populations in American and developed Latin American countries. This study by Becker and others focused on low-income individuals of Mexican and Central American descent residing in the San Francisco Bay area. Their findings revealed that many low-income Latinos face exclusion from infertility treatments due to disparities in access to IVF facilities. This infertility challenge subsequently affects their social lives, hindering their ability to fulfil cultural expectations and traditional gender roles. Despite some shifts in gender roles prompted

by migration, where women experience a degree of autonomy, the importance of having children remains a central cultural expectation for these communities. The lack of access to medical facilities impacts both men and women within this community. This study also discovered that low sperm count significantly challenges men's notions of virility and masculinity. Consequently, infertility often leads to marital discord. Becker et al.'s work emphasises the importance of comprehending the experiences of involuntary infertility within the Latino population, particularly when they lack access to appropriate medical facilities (Becker et al., 2006).

Stuhmcke, Millbank, and Karpin (2020) contend that the global ART industry employs tactics to stimulate demand for infertility treatments. The proliferation of the Internet has facilitated the exchange of information, including transactions involving reproductive materials. Across the globe, individuals are actively utilising the Internet to explore matters related to fertility. It has emerged as a substantial information source for those searching for fertility treatments. In their research, Stuhmcke, Millbank, and Karpin (2020) delve into the role of the Internet for Australian women seeking fertility treatment, mainly how it aids in involving strangers in the intimate decision-making process surrounding reproductive choices. Anita Stuhmcke and colleagues' (2020) study delves into the significance of online platforms for Australian women pursuing fertility treatments. These women utilise 'peer fertility egg recipient forums,' an online site to gather information and insights about overseas egg donation. This online data sheds light on the underlying motivations and driving factors that lead women to opt for ART treatments, offering valuable insights into the decision-making processes of individuals seeking these treatments.

In Canada, Weissman and colleagues (2000) conducted a study to assess and compare internet utilisation among infertile couples attending government-funded or private ART clinics. The research intended to understand the correlation between income and education levels influencing ART choice. The findings revealed that patients at private clinics generally exhibited higher levels of education, employment, and combined family income. A logistic regression model used in this study shows that none of the socioeconomic or clinical variables predicted internet usage among patients. Interestingly, the study result showed that in both the government-funded and private clinic groups, many patients had turned to the Internet for information on fertility matters despite sharing a differential socioeconomic background. The

study indicated that most patients found the Internet valuable in guiding their decision-making processes.

IVF in the global south: A diverse approach

As technological advancements surged in tandem with the rapid growth of the global economy, their adoption became widespread worldwide. However, a notable distinction emerged between the Western context and developing countries regarding in vitro fertilisation (IVF). IVF took on a more commercial form in developing nations, blossoming into a multi-billion-dollar industry called the 'surrogacy industry' (Pande, 2014, P. 19). Within this framework, women from non-Western backgrounds began offering their wombs for rent, marking the inception of surrogate motherhood (ibid). This phenomenon gave rise to surrogate mothers who bore children on behalf of racially and economically privileged individuals. Within this industry, a form of eugenic reproduction emerged, marked by selective breeding based on factors such as hair, skin colour, and gender. The evolution of related technologies like Preimplantation Genetic Diagnosis (PGD) and Preimplantation Genetic Screening (PGS) contributed to this trajectory (Daar, 2017). A substantial debate unfolded among scholars, spanning the Western and non-Western spheres. Much of this discourse stemmed from empirical investigations, which grappled with the profound implications of these technologies on various stakeholders' lives. This encompassed commissioning parents, surrogate mothers, and the broader array of individuals involved in the surrogacy arrangement.

In 2009, Ryan delved into the issue of infertility globally, analysing the widespread expansion of the (ARTs) market. This market has extended beyond developed American society, reaching into developing nations such as India, various parts of Asia, Africa, Latin America, the Middle East, and China. Ryan's exploration positions ARTs as a universal concern in contemporary times. In doing so, the author delves into feminist perspectives that aim to integrate human rights and developmental viewpoints, creating a platform for discussing transnational bioethics. Ryan's objective is to draw a parallel between the international approach to human rights and the localised economic, political, and cultural factors that influence women's agency in navigating the experience of infertility. By juxtaposing these two angles, the study attempts to offer a comprehensive understanding of how women's agency operates within the context of ARTs on a macro level.

In a study by Inhorn (2006a), an examination was conducted to contrast the obstacles African-American and Arab-American women face in accessing infertility care. The study employed semi-structured and open-ended ethnographic interviews as its foundation. The findings underscored that Arab Americans and African Americans residing in metropolitan Detroit face an elevated risk of infertility. These groups encounter difficulties obtaining medical assistance due to their historical, social, and cultural marginalisation within mainstream US society. In another exploration by Inhorn (2006), it became evident that divergent ideological viewpoints within religious groups shape the utilisation of ART in the Muslim World. In the Middle East, the authorisation and limitations on ART often align with religious edicts. Inhorn's observation revealed that significant distinctions exist between Shia and Sunni Islamic communities regarding the accessibility and regulations associated with ART. The localised interplay of social, cultural, economic, religious, and political factors has influenced the availability of ART and its reception by couples grappling with infertility. This study further endeavoured to unravel the gender implications entwined with gamete donation within the context of Muslim marriages.

Vertommen (2022) embarked on an expansive, multi-sited, collaborative transnational research endeavour encompassing Israel/Palestine, Romania, Georgia, and Spain. The study pursued two distinct analytical objectives within the framework of the global fertility chain. It aimed to map the fertility chain and unravel stakeholders' geographical scope and activities in the reproductive bio-economy. The second objective entailed analysing the value chain and dissecting the roles played by dynamic factors- from labour and biological networks, institutional governance, technological innovations, and colonial histories to interfirm relationships—in shaping the evolution and profitability of fertility services.

Vertommen (2022) conducted sixty semi-structured interviews to achieve the study objective involving surrogates, egg cell providers, surrogacy agents, fertility doctors, government officials, and lawyers in Israel between 2012 and 2019 and in Georgia in 2018. Similarly, Vincenzo Pavone's research encompassed twenty semi-structured interviews conducted with medical practitioners, embryologists, gynaecologists, egg bank coordinators, and marketing directors in eleven hospitals across five regions of Spain between 2013 and 15. Michal Nahman extended her research to Israel/Palestine, Romania between 2002 and 2010, and Spain between 2016-18, engaging in interviews with recipients of reproductive services and egg providers and undertaking ethnographic research within egg donation clinics. From the amassed data, the

researchers define the "Fertility Chain" as a complex interplay of practices, operations, and transactions interlinking firms, states, and households globally. This intricate web facilitates the production, distribution, and consumption of specific reproductive services, commodities, or data, such as eggs, surrogacy, stem cell lines, regenerative drugs, and therapies. This configuration constitutes the reproductive bio-economy, where practices, operations, and transactions merge across entities and regions, forming a network that propels the creation, dissemination, and consumption of reproductive services and commodities. By undertaking this study, the authors illuminate the fusion of value, biology, and technoscience, along with the governance mechanisms governing these aspects, in capital accumulation.

IVF in Indian context

Many Indian scholars have studied IVF within the country, drawing insights from real-world data. Gupta, J.A. (2000) conducted a comparative analysis involving India and the Netherlands, focusing on population policies and the societal ramifications of emerging reproductive technologies, particularly concerning women. Their study underscores the historical trend of women in both nations becoming subjects of experimentation and exploitation, manipulated by various actors, including government bodies, national and international NGOs, market forces, and technological advancements. This trajectory extends from historical population control measures to the contemporary proliferation of innovative reproductive technologies, such as IVF, underpinned by the framework of neoliberal economic policies. Gupta (2000) delves into ARTs as a distinct category of reproductive technologies, diverging from conventional contraceptive methods.

The scholars adopt a feminist perspective to scrutinise these technologies, paying particular attention to women's reproductive rights. Their argument contends that the modern advancements in scientific and technological arenas of human reproduction remain entrenched within a domain of patriarchy and male dominance, a sphere once predominantly associated with women, including mothers and midwives. This evolution has culminated in the construction of motherhood through a lens of patriarchal ideology, perpetuating the subordination of women. A shared observation across both countries is that the ideals of motherhood wield influence over women's agency concerning reproductive decisions. The study's proposition suggests that fostering equitable gender relations necessitates a revaluation of the relationship between women and motherhood. The authors advocate for disentangling women from the concept of motherhood, thereby empowering women with the authority to

exercise control over their 'own' reproductive bodies. This separation, they contend, is a crucial step toward achieving a state of balanced gender dynamics.

Drawing a political-economic perspective, Gupta (2012) posits the existence of a "Human Organ Market" that trades body parts, including organs, tissues, and reproductive components, to serve the global medical industry. Human bodies have evolved into "biological capital," deposited within bio(technology) banks encompassing blood, sperm, embryo, gene, tissue, and cord blood banks. Gupta (2012) contends that these repositories allow public access, transforming bodies into commodities. Gupta (2012) also delves into how biotechnology contributes to the fragmentation and commodification of the female reproductive body. The progression of biotechnology has endorsed the notion of the "Body as a machine composed of different parts." This process involves a multifaceted array of participants within the "Human Organ Market." As Gupta (2012) asserts, commodities have broken free from direct producer-consumer connections, bought and sold, circulating within extensive, even global networks. While the exchange of human organs has historical precedent, the distinctive aspect lies in the capacity to replace defective body parts and their subsequent objectification through transplantation and reproductive medicine. Gupta (2012) further underscores that this trend has shifted the emphasis from the entire body to smaller components, encompassing the uterus, eggs, embryos, and microscopic entities like cells, genes, and DNA.

Consequently, Gupta (2012) argues that this has contributed to the devaluation of women, reducing them to childbearing mechanisms rather than holistic individuals. The "global market for the bio-economy of assisted reproduction technology" discussed by Gupta encapsulates the pursuit of parenthood across borders, often utilising donor gametes and surrogacy. This paradigm, Gupta asserts, has marginalised economically disadvantaged women due to the neoliberal development model's exclusionary nature, resulting in surrogacy emerging as a survival strategy and means of social advancement.

Other Indian scholars, including Dasgupta, S., Dasgupta, S. D. (2010), Sengupta, A. (2018), and Rudrappa, S. (2015) have contributed ethnographic insights to the discourse surrounding 'surrogacy' in India, which emerged mainly after the proliferation of IVF technology. However, the landscape of ART transactions is intricate, entwined with moral considerations intertwined with reproductive economics. Gupta and Richter's (2008) empirical research into IVF clinics highlights that egg donors in India are often relatives, such as younger sisters, cousins, and sisters-in-law, and the recipients express gratitude toward the donors, perceiving their actions

as gifts. Conversely, donors find fulfilment in granting someone else's wish. Monetary transactions are often understated or hidden, and the notion of body parts as commodities is further blurred when recipients view donors as endowing them with a valuable gift—a potential child they have paid for. In Indian society, where self-sacrifice is ingrained and pleasing others is prioritised, women's inclination to give is considered inherent. Gupta and Richters (2008) contend that this pressure for altruism extends to female relatives volunteering as donors, whether for kidneys or eggs. Gupta and Richters argue that the dynamics of social relationships persist even in commercial transaction contexts across countries.

Kaushik Sunder Rajan's work, *Bio Capital: The Constitution of Post Genomic Life*, published in 2006, is a multi-sited ethnographic account that studies the genomics and post-genomic drug development marketplaces in the United States and India. A "Bio Capital" framework is developed to explain the influence of market logic in the life sciences epistemology. Biotechnology and its interlinkages are linked to contemporary capitalistic market economies. Its contextualisation of science, Rajan argues, cannot simply be understood as a unidirectional attribution of causality; there is a mutual constitution of the "scientific" and "the social" as co-production. He examined the goals and practice of research, the relevant government regulations, the financing mechanisms, and the hype and marketing surrounding advanced new technologies. Rajan conducted his fieldwork in small start-up companies and biotechnology labs in the United States (mainly in San Francisco) and India (mainly in New Delhi, Hyderabad, and Bombay) from 1999 to 2004. In his work, Rajan illuminated different aspects associated with the global flow of ideas, information, capital, and people connected to biotech initiatives.

Rajan (2006) remarked on the expansion of the "Genomic industry" into the Global Political Economy. In contemporary times, the Genome Industry has become and is determined by world "knowledge, information and promises." Scientific Researchers and the Pharmaceutical industry have collaborated at various levels. The biotechnology industry is a leading player in the modern capitalist economy. It is argued that the developments in the ART are guided more by marketing decisions. Scientific innovation has less of a role to play in this. Rajan (2006) argued that the intersection of biotechnology and market forces shapes the contemporary world. Besides Biotechnology companies, medical practitioners and scientific researchers have also started to earn profit from the proliferation of the biotechnology Industry. Multiple players are essential in "Genetic Research" (Life Sciences) in the USA and India. Rajan revealed extravagant industry conferences and company parties in India's United States and Science and

Technology parks for corporations, Scientists, entrepreneurs, and CEOs. This has critical geophysical and material implications for the industry. Rajan (2006) demonstrated that inequalities exist in the "Bio Capital." It is argued that a new economy of genomics exists on the power inequality between the Developed and Developing/Under-developing world. This work exposed that a hierarchal system exists in the international arena. India plays a supplementary role in providing the raw population base as experimental subjects for mapping the human genome for western-based multinationals which would further process, brand, repackage and patent new and costly databases and drugs to be sold back to the developing world (Rajan, 2006).

Bharadwaj's research in 2006 focused on the adaptation of ARTs from Western nations to India. Using a multi-sited ethnographic approach, I conducted comprehensive interviews with infertile couples undergoing IVF treatment and clinicians across five major Indian cities, including Delhi, Mumbai, and Hyderabad. By examining narratives from clinicians and technology users, Bharadwaj's (2006) findings suggest that the swift evolution of ARTs, particularly IVF, has constrained their application solely to addressing infertility. In this process, clinicians and those seeking fertility solutions have internalised the "Western technoscience" of conception. Bharadwaj (2008) introduced the term "Bio Crossing" to encapsulate this phenomenon. Individuals traverse national borders, often covering extensive distances, driven by their pursuit of a biologically or genetically related child. This journey involves the shared reproductive bodies of individuals and donors, physically transported across geographical, ethical, commercial, and moral boundaries. "Bio Crossing" encompasses the intricate movement of the human body across diverse tangible, philosophical, and political borders, reflecting the interplay between culture, history, and politics. Based on this argument, Bharadwaj (2016a) illuminated how the demand for ARTs and the prominence of their experts are being cultivated in India through media narratives. By employing an extensive analysis of these narratives, the study revealed that these media portrayals, effectively characterised as "institutional advertisements," have successfully constructed a credible image of medical expertise, often sidestepping ethical medical standards. The author contends that the existing stigma linked to infertility within India provides a fertile ground for the expansion of the ART industry. Notably, mainstream media, including newspapers, popular magazines, scientific journals, television reports, documentaries, and talk shows, have further bolstered the ART sector's engagement with fertility concerns.

Bharadwaj's ethnographic work in 2016 introduced the concept of 'cultural conception' within the context of IVF. This concept delves into the intricate relationship between infertility, assisted reproductive technology, and the cultural milieu. Bharadwaj (2016b) delves into the perspectives of both clinicians and infertile couples, unravelling their interpretations of the cultural dimensions that underpin their experiences. In summation, Bharadwaj's comprehensive research provides insights into the complex dynamics of ART adoption in India. His work examines the intertwining of medical advancements, cultural contexts, and media influences, shedding light on the multifaceted landscape of assisted reproductive technologies.

Sarojini, N. B., Nayak et al. (2010) conducted a study that observed lifestyle factors such as obesity, eating disorders, alcohol or tobacco consumption, and occupational hazards contributing to infertility in both men and women (Sarojini et al., 2010). A study conducted by the Research Centre 'Centre for Science and Environment' (CSE) in 2002 revealed that men living in clean areas had six times healthier sperm than those in industrial and polluted towns (Lal et al. 2002). Developing countries experience infertility due to unhygienic delivery, postpartum infections, and deficiencies in iodine or selenium (Stewart, 1991). The report sheds light on the experiences of couples visiting India for ART procedures. Globally, India has become a significant hub for medical tourism, ranking second in 2007 with 450,000 medical tourists. India's advantage lies in cost-effectiveness, fewer legal constraints, English-speaking providers, advanced technology, low-interest loans, and accessible medical visas. The report also highlights diverse strategies adopted by different states in India to bolster medical tourism. The private Manipal Group in Karnataka attracts investment by offering medical tour packages to West Asian countries. Tamil Nadu initiated a "media tour" to encourage medical tourism. However, the study underlines weak legal regulations governing ART processes in India. The ART Bill of 2010, criticised for its loopholes, only covers ART banks and clinics, lacks a specified maximum age, raises the limit of delivered children from 3 to 5 (including the couple's own), and mentions insurance for surrogate mothers and children but overlooks legal support for mothers. ART clinics are primarily urban-centric, and the industry is progressively shifting from the public to the private sector, becoming profit-oriented. Various strategies, including extensive advertising, website design, and campaigns in public spaces like railway stations, bus stands, and adoption centres, are employed to generate demand for ART services. Clinics organise camps with discount schemes and cashback offers.

Sama, a Delhi-based resource group focusing on Gender, Health, and Rights, conducted research from 2008 to 2010 across three Indian states: Uttar Pradesh, Tamil Nadu, and Orissa. The study interviewed 43 ART providers and 86 women undergoing IUI, IVF, or ICSI. It examines the proliferation of the ART industry in India and how it capitalises on patriarchal values, cost promotion, and marketing. In India's traditional society, women disproportionately bear the blame for infertility, leading to stigma and social exclusion. The ART industry markets these technologies as "pro-women," claiming to alleviate the suffering of infertile women. However, the study shows that promotional images, language, and slogans downplay concerns and complications associated with medical interventions, sidestepping issues like side effects, efficacy, and costs. The study accentuates how the commercial flow of reproductive material underscores the division of bodies into saleable parts, touching on issues of structural inequality (Perappadan, 2010).

Majumdar (2021) discussed the relationship between age and fertility/infertility in two different demographic conditions in infertility clinics. This data was collected for the study from the North (Hisar) and the South (Hyderabad). The study highlighted how ageing and infertility are distinct issues in infertility clinics, but the treatment protocol moves based on society's social and moral values. This paper focuses on two connected terms but does not lead to the same meaning: fertility and reproduction. As a female starts ageing, her eggs decline, and once she is about to reach menopause, it is symbolically considered as "death" (Lock, 2007; Martin, 2001). It does not mean it is only related to females; the same applies to males. The study showed a growing tendency among women in their 20s to get their oocytes frozen as they had just started their careers. The author also mentioned that companies like Google and Facebook 2017 used freezing oocytes to let female employees work more comfortably without worrying about their biological clock to have a family (Majumdar, 2021a, p. 62).

Through her ethnographic exploration within Delhi, Anindita Majumdar's study in 2017 delves into multifaceted intimate relationships encompassing commerce, families, and kinship, particularly in the context of transnational commercial gestational surrogacy arrangements. By employing perspectives from new kinship studies, her work scrutinises how the anthropology of kinship grapples with the interplay between biology and interpersonal bonds within gestational surrogacy. Majumdar's research reveals that IVF surrogacy clinics occupy a unique space within the landscape of reproductive technology. While these clinics align with Euro-American notions of kinship rooted in global uniform norms, their operational reality is

intertwined with the intricate, varied, and evolving practices of South Asian kinship within local cultural contexts. Beyond the apparent ideological narratives, her study underscores that Euro-American and South Asian kinship ideologies are moulded and reshaped in the crucible of the "surrogacy industry." Majumdar highlights the dynamic interaction between global norms and local practices within transnational commercial gestational surrogacy arrangements. The study elucidates how various forms of kinship ideology, irrespective of origin, undergo transformation and adaptation in the context of the practical and intimate dynamics prevailing within the "surrogacy industry." In a subsequent study, Anindita Majumdar delved into the complex interaction between assisted reproductive technologies and the ageing process in India (Majumdar, 2021).

Discussion: A Critical Reflection on contestation around IVF technology

The literature review comprehensively explores ARTs, particularly IVF technology, from its historical origins to contemporary applications. Within this discourse, feminist perspectives have contributed diverse viewpoints critiquing IVF technology and its utilisation. The feminist critique of IVF technology encompasses a range of approaches, commencing with analyses of its underlying motives and intentions. A central contention posited by feminists is that male scientists developed these technologies to control women's reproductive capacities and bodies. Early radical feminists perceived these technologies as intrinsically patriarchal, given their inception and implementation within a predominantly male-dominated scientific landscape. Moreover, during this era, women, especially in Western societies, were concurrently striving for reproductive rights, including access to abortion, to reclaim autonomy over their bodies and choices.

Nonetheless, these initial radical critiques fail to account for women with involuntary infertility, same-sex couples, and others necessitating technological interventions for medical reasons. The highly radical stance of this feminist faction was built around the international organisation FINRRAGE, consequently lacking sustainability. As the latter half of the 20th century unfolded, a faction of feminists affiliated with and external to FINRRAGE emerged with a more moderate standpoint, advocating for certain aspects of this technology. These feminists prioritise women's health and the significance of informed consent, emphasising that a woman's technological choices should be informed by her own decisions. Several advocates within this category draw from personal encounters with infertility or infertility treatment, particularly involving IVF technology. Although these more lenient feminist voices bring

attention to women's "choice" in reproductive matters, akin to the radical feminist viewpoint, their approach overlooks ethnic and racialised marginalised women. Notably, "reproductive choice" predominantly reflects the perspectives of middle-class white women residing in affluent regions of the global North.

Subsequently, researchers, predominantly social anthropologists, including those within feminist anthropology, endeavoured to dissolve the rigid binary classification of IVF technology into categories of 'good' and 'bad,' or 'right' and 'wrong.' This shift led to a transformation in the discourse, previously dominated by proponents and critics of the technology's moral implications. The transformation emerged by incorporating empirical data derived directly from women who had encountered or were undergoing infertility and subsequent technological interventions. By introducing a cultural dimension to the understanding of fertility, infertility, and technological assistance, these scholars constrained their examination of women's experiences and subjectivity within less complex societal contexts.

As the global economy underwent expansion propelled by the rise of globalisation and capitalist forces, these technologies transcended geopolitical borders, becoming integral to globalisation. This pivotal global transformation prompted a fresh wave of research conducted worldwide, encompassing the use and consequences of these technologies in both the affluent global North and the developing global South. Scholars hailing from diverse backgrounds engaged in this research endeavour took various strands. Within the global North, one strand of studies delved into the nuanced experiences of men and women grappling with infertility and undergoing IVF treatment in the specific context of the so-called global North. These investigations probed the intricate connections between these technologies, the global economy, political landscapes, and the social implications.

Conversely, another strand of research sought to illuminate the glaring disparities in technology access, particularly among lower-income individuals, racial and ethnic minorities, and people of colour in non-Euro-American countries. These scholars deliberately emphasised the cultural significance of infertility and its far-reaching impact on individuals' lives. This type of research views technology, science, and society as distinct and separate entities, often considering them as binary opposites existing in different domains. Moreover, they have tried to bring the cultural importance of infertility and its ramifications in people's lives. They have advocated for equal distribution of technological access within countries that promote pro-natal policies.

Studies conducted in the global South, focusing on India, have predominantly delved into the intricate social landscape of surrogacy. This phenomenon has emerged due to the commodification and globalisation of IVF technology. Within these studies, an endeavour has been made to establish a link between commercial surrogacy and the broader discourse on global inequality. The argument posited is that these technologies carry inherent exploitative tendencies, thereby contributing to a novel form of inequality within the global South. A subset of scholars, approaching the subject from a cultural anthropological perspective, has specifically directed their attention toward surrogacy, particularly in commercial transnational surrogacy. Their observations highlight that surrogacy, in conjunction with IVF technology, not only gives rise to distinct kinship systems but also reconstructs traditional family relationships, values, and social dynamics. This line of inquiry underscores the process of "re-traditionalization" occurring within social relations due to these technologies. Notably, these studies predominantly operate within the framework of socio-cultural perspectives and perceive technology as a distinguished realm from social life.

Most scholarly research centred around IVF technology and its related domains has focused on 'women' as assumed participants upon whom this technology is primarily tested or requires its application. Studies concerning men or masculinity have remained conspicuously absent within most social investigations concerning IVF, with scant attention paid to contexts beyond Euro-American societies (Becker et al., 2006; Schrock & Schwalbe, 2009). Limited explorations have touched upon the psychological relationship between men and reproduction (Greil, 1997; Harrison et al., 1987). In the instances where research has been conducted in non-Euro-American societies on men's experiences with infertility treatment within the framework of IVF, the emphasis has often been on the emergence of unique forms of masculinity in contrast to Connell's overarching concept of hegemonic masculinity (Inhorn et al., 2011). Notably, the ethnographic investigations carried out by Inhorn and Wentzell are primarily centred in the Middle Eastern and Mexican contexts. Scant attention has been devoted to studies addressing male infertility, particularly within the context of IVF, in South Asian countries, particularly India. Scholars like Radhika Chopra (2006) underscore that the study of gender and masculinity in South Asia has remained a relatively muted field for a considerable period. While a few studies have explored masculinity within the South Asian context, their focus has been linked to men's labour or the theoretical exploration of masculinity (Chopra, 2006; Chopra et al., 2004; Srivastava, 2004).

Exploring IVF through a network framework: Discussing the interplay of actors

The discourse surrounding ARTs, particularly IVF, has often treated technology as a separate entity in opposition to society. Empirical investigations into IVF tend to isolate it within the social structure, portraying it merely as an object controlled by human interactions. The absence of technology as an active agent is frequently taken for granted, overlooking its potential agency (Heeks & Stanforth, 2002, p. 36). As discussed earlier, IVF and ARTs are intricately shaped by multifaceted social, political, and economic factors, demanding a departure from singular perspectives (Franklin, 1997). Modern technoscientific thought argues that existing binaries are dissolving, merging lived social realities with scientific imagination, epitomising what Haraway termed 'cyborgs' (Haraway, 1990). The hybrid relationship between humans and technology depicts a theoretical overview of the relationship between technoscience and human technology, leaving society's reality unexplored.

Preliminary findings from the pilot study of the field suggest that IVF technology operates within a network of stakeholders: from providers like doctors to intermediaries such as markets and media, and from direct users, prospective parents, to the regulating state. These stakeholders' relationships are complex and deeply embedded in the social, economic, cultural, and political systems. Likewise, the detailed discussion of the logic and origin of IVF technology remains underexplored, except a few scholars discussed its historical anecdotes from the twentieth century onwards (Bharadwaj, 2016a; Bärnreuther, 2016).

The present study explores IVF as a distinct entity juxtaposed to societal considerations. This prompts the question: Is IVF technology a standalone entity detached from society? Are its users solely consumers, passive technology adapters, or active agents engaging within the sociotechnical paradigm? Does technological appropriation occur within a realm isolating the technology, its users, and the providers into a binary relationship? How do different actors play out in the IVF network, which not only is the mere consumer of the technology but also acts and creates meaning that benefits the IVF network to get stabilised and legitimised? Who are the actors in the IVF network, and how do actors in the network make meaning? How is IVF technology as a sociotechnical ensemble subjected to reinterpretation suiting the needs of the consumers? How IVF is appropriated is another essential dimension of this research.

Within science and technology studies (STS), an actor is understood as an entity that acts. Actor-network theory (ANT) defines "actors in a semiotic definition actant-that is something

that acts or to which others grant activity” (Latour, 1990:7). The definition of an actor is therefore not limited to individual human actors and is extended to anything which holds the agency to act and granted to be the source of an action. By keeping the time limit and nature of work, the present study limits the study of actors like couples seeking IVF treatment, reproductive specialists and clinicians, regulatory bodies, i.e., state, cultural beliefs, assisted reproductive technologies within IVF network, media and market, embryo.

A further question arises about understanding actors as separate entities from the system. Can actors truly be separated from the system? Can actors be understood within a network? The critical standpoint within the social shaping of technology argues against technological neutrality, asserting that groups shape technologies to influence social dynamics (Hard, 1993). Thus, ARTs need to be studied as 'sociotechnical systems' (Hughes, 1991) or ensembles (Bijker, 1993, p. 95) that mobilise actors within networks (Law et. al., 1992). In this deterministic gap, the present research seeks to explore the 'IVF network' using Science and Technology Studies (STS) perspectives. This study delves into the interplay between actors and decision-makers within the development of the IVF network and its subsequent utilisation in the specific context of Hyderabad city.

Employing STS concepts, the study acknowledges that technology is not inherently progressive, oppressive, or neutral but is socially constructed. The research draws on STS to comprehend how various actors experience IVF technology in their daily practices. It rejects deterministic perspectives that oversimplify the relationship between technology and society. Instead, the research embraces the Social Shaping of Technology (SST) approach, investigating how technology interacts with and shapes society. Drawing a conceptual understanding from Actor-Network Theory (ANT) developed by Law, Collin, and Latour, this study analyses the intricate interplay between technology and various actors, including individuals, markets, media, and the state. Actor-network theory is a theoretical framework (also considered as a methodological approach) that emphasises the significance of both human and non-human actors in shaping social outcomes. It advocates that social structures are not predetermined or fixed but are constantly being produced and reproduced through the interactions of human and non-human actors within networks. ANT suggests 'a relational and process-oriented sociology that treats agents, organisations, and devices as interactive affects' (Law, 1992). This approach prioritises the significance of uncertainty in social outcomes and advocates that social structures are constantly being negotiated and contested. Overall, this theory provides a more

dynamic perspective that helps identify the factors contributing to the network's power dynamics and inequalities (if they exist). This framework elucidates how social dynamics emerge from the interactions within the IVF network, offering a holistic understanding of technology's role in shaping contemporary societal landscapes and vice versa within the context of Hyderabad. The following research questions have been formulated considering the research gaps and theoretical understanding.

- How do scientific ideas, social values, and philosophical orientations interact with each other historically to produce IVF and other related technologies?
- How do power relations and hierarchies emerge within IVF networks, and how do actors shape these relations?
- How do different networks, such as IVF networks, markets, state, media, and medical institutes, interact with each other, and what are the implications of these intersections for the reproduction of social structure and power relations?
- How do different actors within the IVF network negotiate and contest the meanings and values associated with IVF practices and technologies?

Objectives

- To identify non-human and human actors involved in the IVF network and to explore how they interact and shape the outcome of IVF.
- To examine the role of social actors, such as ideas, values, and norms, in shaping the structure and dynamics of the IVF network.
- To analyse the power relations and hierarchies that emerge within the IVF network and how the interaction of human actors such as doctors, paramedical staff, prospective parents, and non-human actors such as scientific epistemologies, technologies used in IVF procedure, bio-medicines, embryos, eggs, sperms, state, media market, contribute to the production of these relations.
- To examine the changes within the IVF network over time and to explore the factors that contribute to these changes, including the emergence of new actors, changes in regulatory frameworks, and the development of new technologies.
- To explore how different actors within IVF networks negotiate and contest the meanings and values associated with IVF practices and technologies and how these negotiations shape the outcome of IVF.

Understanding IVF network: Identifying actors

The IVF network comprises a complex interplay of human and non-human elements, with IVF procedures at its core. This network facilitates ARTs to help individuals or couples realise their pregnancy aspirations. The IVF network encompasses various sub-networks operating during distinct stages of this medical process. A pivotal network within this framework is the "techno-medicine network." The IVF procedure typically spans three to four weeks, though the duration varies case by case. Throughout the IVF process, an array of techniques and tools are employed. These include diverse syringes, catheters, screening methods such as sonography, ultrasounds, blood tests, and hormonal injections like progesterone and estrogen. While pinpointing exact timelines for IVF stages can be challenging, it is commonly divided into three phases to facilitate a comprehensive understanding of the process within the techno-medicine network.

The initial phase involves screening prospective mothers and fathers and administering hormonal medications to stimulate egg production. The second phase entails retrieving mature eggs from the ovaries, fertilised with sperm in a laboratory to develop embryos. A prevalent method is Intracytoplasmic Sperm Injection (ICSI), in which a single healthy sperm is directly injected into an egg for fertilisation. Dr Gianpiero Palermo pioneered this technique and revolutionised male infertility treatment. The development of ICSI, which is now widely integrated into IVF procedures, is used more among advantaged-age patients with or without male factor infertility to maximise fertilisation (Farhi et al., 2019; Haas et al.,; Orvieto, 2021).

More recently, fertility centres have adopted frozen embryo transfer (FET), wherein embryos are frozen for five days until they reach the blastocyst stage, leading to improved success rates. Matured embryos are often frozen and transferred to the uterus in the final phase using a catheter. Utilising blastocyst embryos during transfer is associated with higher IVF success rates. In some cases, embryos undergo preimplantation genetic diagnosis (PGD) before transfer to identify chromosomal defects or genetic diseases, enhancing the chances of a successful outcome. Post-transfer, an endometrial receptivity array (ERA) may be conducted to determine the window of implantation.

Aside from the techno-medicine network, medical institutions form their network within the clinical setting. This network involves various human and non-human actors such as reproductive specialists, embryologists, genetic specialists, and paramedical staff like nurses.

Additionally, the IVF laboratory is a crucial component. The beneficiaries of IVF technology, prospective couples, play a significant role in the network.

Socio-cultural factors, including social expectations, family and kinship norms, moral and cultural values, and gender roles, construct a network that influences prospective parents' decision to choose IVF.

Furthermore, actors like the market, media, and the state form a network that shapes the IVF landscape by distributing, proliferating, and regulating the technology. The state regulates and legitimises IVF, the Media disseminates information on IVF and its use and assists the market in commercialising IVF, making it accessible to the limited few who can afford it. It is important to note that this study primarily focuses on comprehending assisted reproductive technologies within the IVF Network, encompassing intricate techniques and their interaction with various actors.

Organisation of chapters

This dissertation has been structured as follows. The introductory chapter describes an overview of the research topic, specifically focusing on the social study of ARTs, with IVF technology at its core. Existing literature on IVF is thoroughly reviewed to establish the context for the study. The literature review is followed by identifying the research problem, formulating research questions, and outlining objectives.

Chapter Two, titled *The Journey into Fertility Industry: Reflections on Methodology*, elaborates on the field site and methods used for data gathering and analysis, including the researcher's reflections on the field from her subjective position. The researcher conducted field investigations across various sites using an ethnography approach. Different sites of the field are elaborated upon in this chapter, accompanied by a summary of the reflexive thematic analysis that highlights key themes. Furthermore, the researcher's field experience is detailed using a 'reflexive ethnography' analytical method (Paul et al., 2001). The chapter covers data collection and analysis techniques.

Chapter Three, *The Evolution of Assisted Conception: Intersections of Science, Technology, and Society*, delves into the origins and rationale behind In Vitro Fertilization (IVF) as an ART, placing it within developmental biology debates. This chapter engages with multidisciplinary perspectives, including philosophy, society, politics, and science, to examine the emergence of

IVF. The shift from understanding life's origin to developing cell and embryology theories is explored. The chapter traces the historical influence of socio-cultural and political values on scientific and medical advancements. Additionally, the invention of IVF and the broader landscape of ARTs are discussed. The interplay between scientific concepts, socio-cultural values, and contextual power dynamics in shaping IVF is emphasised. The procedural journey of IVF, entailing various technologies and interventions, is presented through a sociological lens employing the Sociology of Scientific Knowledge (SSK) and Social Shaping of Technology (SST) approaches.

Chapter Four, *Unravelling Women's Agency in IVF: Socio-Cultural Dynamics and Everyday Experiences*, investigates how women perceive reproductive choice within the IVF network. Through narratives, the chapter explores women's perspectives at different stages of their IVF journey. The first section delves into themes such as 'biological lack' and negotiating autonomy through technology, empowerment via technological advancements, gender dynamics, and moral agency. The second section delves into women's experiences during the IVF treatment, highlighting their spatial journey. Themes explored include 'normalising pain,' 'moral dilemmas,' and navigating uncertainty with hope.

Chapter Five, *Men, Masculinity, and Reproduction: Lived Experiences with IVF Technology*, analyses men's experiences engaging with IVF for their fertility issues or those of their partners. The chapter is organised around six themes: redefining reproductive responsibility, navigating male infertility's complex aspects, the impact of masculine culture on IVF choices, male emotionality, reproductive masculinity, and the ethical quandaries around donor treatments. The chapter concludes by identifying a new form of masculinity, characterised as 'emergent masculinity,' shaped by experiences within the IVF process. This emergent masculinity challenges traditional notions and shifts beyond hegemonic and subordinate masculinities.

Chapter six, titled *Shaping Reproductive Choices: Co-constructing Technology, Law, Market, and Media*, examines the intricate interplay of non-human actors such as medical institutions, markets, states, and media. The chapter is divided into two parts. The first part intricately maps how IVF centres function as actors within the broader IVF network, significantly influencing users' reproductive choices through themes including legitimisation of IVF technology and its reinforcement of heteropatriarchal ideology, gendered perceptions of conception, normalisation of infertility stigma, implications of male infertility on gendered stigma, eugenics-linked embryo selection, and the shifting of abled-bodied perceptions via

Preimplantation Genetic Diagnosis (PGD) and Preimplantation Genetic Screening (PGS). Additionally, it analyses how medical practitioners redefine 'own child' and engage with the concept of designer babies within the context of donor treatments. The second part investigates the collaborative influence of the state, media, and market on IVF networks, shaping reproductive choices through themes of the fertility industry's construction by market, media, and state forces, the evolution of state priorities from population control to governing ARTs, governance, and regulation of ARTs, the intersection of market dynamics with hetero-patriarchal ideology, and media's role in shaping IVF perceptions via narratives of hope, credibility, and ambiguity.

Chapter seven, entitled, *Socio-technical Ensemble of IVF: Analysing Negotiated Agency in a Network Relation*, discusses the key findings of the research. In this chapter, the researcher links the thesis findings with the theoretical framework and elaborately discusses the similarities and dissimilarities of the present research with the existing literature on the social study of IVF and within and beyond the science and technology studies perspective. The chapter further discusses the researcher's contribution to the literature of gender studies of IVF. While bringing actor-network theory (ANT) in this chapter, the researcher argues that actors share an asymmetric relation within the network where both human and non-human actors contribute to the formation and stabilization of the network. This chapter ends with recommendations for future research on IVF and related fields from a sociological perspective, specifically by utilising science and technology study approaches, specifically emphasizing the study of the contribution of non-human actors in building the power dynamics with a network.

CHAPTER TWO

THE JOURNEY INTO THE FERTILITY INDUSTRY: REFLECTIONS ON METHODOLOGY

Motherhood is bliss, and why should you miss it.

Twenty-five years of excellence in fertility: The best place to start your Motherhood Journey.

Lowest cost, 10,000 above IVF babies and top most specialists.

The most advanced IVF lab and test tube baby treatment; transparency and trust; no hidden cost; value for money; experts in fertility management with more than twenty years of experience.

Feel the move of your baby in your body: the best fertility centre with the most affordable cost for IVF treatment.

The study site chosen for this research is the vibrant city of Hyderabad, where numerous advertisements promoting fertility services with quotes mentioned above can be found on hoardings behind public buses, autorickshaws, bus stands, metro television screens, and overbridges. For decades, print media reports have highlighted the rising infertility rate in major cities like Hyderabad, especially among the IT and working population.². Fertility experts advocate IVF and ARTs as a solution to this growing issue, leading to a flourishing "fertility industry" in the city, offering IVF and related fertility/infertility solutions. This combination of increasing infertility rates and the proliferation of fertility centres made Hyderabad an intriguing field area for the researcher's study.

Hyderabad, the capital city of Telangana, is located at 17.387140° latitude and 78.491684° longitude, situated at 17° 23' 6.16"N and 78° 29' 12.02"E. It spans four districts, namely Hyderabad, Medchal-Malkajigiri, Ranga Reddy, and Sangareddy, covering a jurisdiction of 900 sq. km. The Greater Hyderabad Municipal Corporation (GHMC) is divided into five zones: East, South, Central, West, and North. The central and west zones, known for being the IT hub of the city, are home to the two hospitals selected as the field sites for interviewing prospective

² See (Anonymous. 2011). Title: Infertility Rate High in IT Sector. The New Indian Express. (Anonymous. 7 March,2014). Stress leading to rise in infertility, say experts the Times of India.

parents using IVF. Additionally, the researcher interviewed doctors and paramedical staff from other fertility centres across Greater Hyderabad.

The growth of the fertility industry in Hyderabad can be traced back to the city's historical development. During the 1990s, the undivided Andhra Pradesh witnessed significant investments in various sectors, including healthcare, entertainment, and education. As Hyderabad expanded, it integrated into the global capitalist market, particularly in IT and pharmaceutical industries, earning the title of India's pharma capital (Jodhka et al., 2023). Developments in real estate, agribusiness, and manufacturing accompanied this industrial growth. Hyderabad's rich cultural heritage and diverse population, comprising people from both South and North India, and various religions, such as Hinduism, Islam, Christianity, Sikhism, and Buddhism, make it a melting pot of cultures. The people of Hyderabad, commonly known as *Hyderabadi*, speak Urdu, Hindi, and Telugu. Their hospitable nature and the convenience of communicating in the local *Hyderabadi* language made the city an ideal research field site for the researcher. Before presenting the details about the field experiences, the respondent profile and methodology are discussed here to clarify the research.

Field profile and time line

Fieldwork spanned from 2016 to 2020 in a distinct time frame. The details of the fieldwork timeline are given in Table 1. Upon auditing coursework papers, the researcher conducted her initial field visit to the Indian Medical Association (IMA) and the Federation of Obstetric and Gynaecological Societies of India (FOGSI), Hyderabad Society, from May to June 2016. During these visits, the researcher sought assistance identifying registered fertility centres and obtaining references to doctors practising surrogacy and IVF. The pilot study's first phase was initiated with an initial field visit. These visits enabled the researcher to gain insights into the field and identify fertility centres engaged in surrogacy and IVF practices.

Additionally, the role of organisations and associations involved in regulating surrogacy through IVF technology was explored during this phase. In late 2017, the researcher encountered difficulties accessing the required data, leading to a shift in focus from studying surrogacy to exploring Assisted Reproductive Technologies (ARTs). The primary emphasis shifted to investigating IVF technology and exploring how different actors play in the IVF network. The specifics of this topic change are elaborated upon towards the end of this chapter, under fieldwork reflection.

The comprehensive list of 1332 private and corporate hospitals, including their respective addresses and contact details, was obtained from the Indian Medical Association (IMA) in January 2018. Twenty fertility clinics were selected from the 1332 private and corporate hospitals registered under IMA, Hyderabad. The criteria adopted for shortlisting hospitals for the study were; reputation of the hospital, references from doctors and acquaintances about these hospitals and proximity. The researcher emailed these twenty hospitals, seeking permission to conduct fieldwork in January 2018. Out of the contacted hospitals, Fertility Centre A (pseudonym) responded after four months and was granted permission for a visit. In April 2018, the researcher began fieldwork to explore the less-studied area of assisted conception. The second phase of the pilot study commenced with informal interactions with outpatients at the hospital. These interactions allowed the researcher to establish rapport with prospective parents seeking IVF and the hospital staff. Two months after the pilot study, in June 2018, formal interviews with prospective parents using a semi-structured interview schedule began. Fertility Centre 'A' fieldwork spanned from June 2018 to October 2019, with intermittent breaks throughout the study period.

Meanwhile, the researcher contacted one of the National Institutes of the City of Hyderabad that deals with maternal health and nutrition. With the help of the National Institute of Health, a few contacts were made with fertility specialists in the city, which helped the researcher interview some IVF specialists. Interviews with prospective parents were not restricted in the Fertility Centre A. Some interviews were conducted from different fertility centres outside the Infertility Centre A but inside Greater Hyderabad, employing a snowball sampling method. During the timeframe extending until December 2019, the researcher continued fieldwork alongside participating in various academic pursuits such as workshops and seminars.

In the meantime, the researcher visited other fertility clinics and conducted interviews with IVF specialists. Reminders seeking permission for fieldwork were sent to a few hospitals from the initial twenty contacts, and the contacts were made later. In December 2019, Fertility Centre B, contacted through the previously visited National Institute of Health (pseudonym), responded to the researcher's email and permitted fieldwork. The hospitable nature of the staff and doctors at Fertility Centre B facilitated the researcher's engagement with more individuals in just four months. Some of the respondents previously interviewed at Fertility Centre A were in touch with the researcher and were interviewed several times. Few of the respondents previously interviewed at Fertility Centre A were also interviewed at Fertility Centre B,

particularly those undergoing their second or third IVF cycle at Fertility Centre B. The researcher conducted interviews at Fertility Centre B until 20 March 2020, when the official lockdown due to the Covid-19 pandemic began. Despite the challenges, the researcher maintained contact with the prospective parents interviewed and established a good rapport, enabling further interviews over telephone conversations to understand their experiences with IVF and the progress of their treatment. Most respondents were interviewed at least twice or thrice during the study. Apart from conducting interviews, the fieldwork also involves observing daily activities in the fertility centres. This observation includes the interaction of prospective parents with doctors and paramedical staff, their negotiation with IVF treatment, interaction among prospective mothers and fathers among themselves in the hospital waiting lounge; interactions among men and primarily women among themselves seeking; observation of advertisements and other kinds of symbolic representations like posters, messages in televisions in the waiting lounge about food and nutrition a pregnant woman needs to take during her conception journey; representation of aesthetic symbols like Goddess which represents the meaning of faith and positivity (according to hospital staffs and the patients); messages and quotes expressing the importance of motherhood and parenthood through, etc. The fieldwork timeline is summarised in the following table:

Table 1: Summary of Fieldwork Timeline and Activities

Key Task	Activities	Time Line	Duration (In months)
Pilot Study (Phase I)	Vising Medical organisations and associations like IMA and FOGSI	May-June 2016	One
Establishing Initial contact	Email sent to 20 private and corporate hospitals registered under IMA	January, (2018).	One
	Response received from Fertility Centre A	April 2018	One
Pilot Study (Phase II)	Informal interactions with outpatients and building rapport with the hospital staff in Fertility Centre A	April- May 2018	One
Interviews (Phase I)	Semi-structured interviews with prospective parents	June, 2018-, December 2018	Seven
Follow up interview	Visits to other fertility clinics, following up and conducting interviews with doctors while keeping in touch with previously interviewed respondents and receiving responses from the Fertility Centre B	January to December 2019	Twelve
Interviews (Phase II)	Interviews and follow-ups at Fertility Centre B	December 2019-March 2020	Four
Total	Interviews, observation in Fertility Centre A, B, and others from Greater Hyderabad, including respondents' homes	2016, 2018, 2019, 2020	Twenty-Seven

Source: Compiled based on fieldwork done from 2016 to 2020.

Note: This fieldwork timeline illustrates the on-site fieldwork conducted in a hospital setting. Subsequent interviews with the same respondents were carried out via telephone until December 2020, amidst the challenges posed by the pandemic. Apart from doing interviews, the study involves observation of field sites.

Participants and methods used for data collection

As discussed in chapters one and two, IVF technology is developed in a discursive practice and in a network of power relations where technologies are developed as persistent and powerful, comprising significant limitations to the liberatory potential of the technologies (Throsby, 2004, p. 20-21). This discourse on the social and political persuasion of in vitro fertilisation (IVF) has taken root and is often debated by social science scholars, feminists, media critics, and ethicists. Despite critiques, IVF eventually legitimised in the global capitalist market, including the Indian market. It took no time for the pro-natal Indian society to accept this technology, providing hope to medically infertile couples for achieving desired parenthood. The controversies around IVF remained active for quite some time in the discourse of scholars and in the public eye regarding the scientific credit and credibility, ethical practice of the same, and the relationship of this technology with women's labour (particularly in the context of commercial surrogacy). Eventually, this technology was accepted by actors of various persuasion, including the technology users, i.e., the prospective infertile parents. As widely debated by social scientists, actors like the state, the market, and the media played a pivotal role in legitimising this technology and establishing a thriving 'fertility industry' (Sarojini et al. 2011 and Bharadwaj, 2016). The legitimisation and appropriation of this technology remained a matter of contestation, which problematised the question of whose need this technology serves and how. It further aimed to understand how this IVF network forms and is stabilised by actors. How do actors act in the IVF network, and how do they resist and accept the process of IVF treatment?

The study has applied an ethnographic approach to understanding and exploring the daily practice of IVF procedures in the hospital setup. Data are mainly collected from two fertility centres in the city of Hyderabad. A few prospective fathers' and mothers' interviews are collected outside the fertility centres using snowball sampling. Observation of hospital settings in fertility centres is made to understand the everyday encounters of different actors with IVF technology. Social media reports from new papers and hospital websites are also recorded to understand the role of media in the IVF network. Government records and market analysis reports have been incorporated to understand the role of the market and state in the IVF network. Greater Hyderabad was chosen as the study universe. In-depth interviews were

conducted with participants, including prospective parents, medical professionals like IVF specialists and doctors, clinical counsellors, hospital staff, and paramedical staff.

Additionally, the research encompassed on-site observations of various locations within the field area. A total number of 67 in-depth interviews were conducted with various respondents. The number of interviews by respondents' categories is given in Table 2.

A semi-structured interview schedule has been used to conduct the interviews. The analyses are also based on observation in the hospital settings in the waiting place of the prospective parents. Apart from analysing interview data, few doctor-patient interactions or negotiations have been recorded for the study while maintaining the privacy of the responses and with the consent of both the doctors and patients. The findings from the study had also been triangulated from data gathered from government records, media reports, and field observations. Details of individual actors interviewed for the study are summarised in the table below.

Table 2: Respondent Categories

Respondent Category	Number of Interviews
Prospective Mothers (interviewed along with the spouse)	7
Prospective Mothers (Alone)	25
Prospective Fathers (interviewed with the spouse)	7
Prospective Fathers (Alone)	13
Medical Practitioners	11
Accompanying person with Prospective mother	4
Total	67

Source: Compiled from the data collected from the field.

Note: Apart from conducting in-depth interviews, data used for the study involves informal conversations with respondents and field observations.

Data are collected for the study from the individual participants using in-depth interviews and informal conversations. Table 2 depicts the results of a comprehensive study, which involved 67 in-depth interviews. These interviews covered a diverse group of participants, including prospective parents, medical practitioners, and relatives or family members of the prospective parents. Among the interviews, 25 prospective mothers were individually interviewed, and seven women were interviewed in their spouse's presence. Similarly, 13 prospective fathers were interviewed alone, and seven were interviewed in the presence of their spouse. In addition to prospective parents, four interviews were conducted with accompanying persons or family members of the prospective parents.

Moreover, the study included 11 interviews with medical practitioners, including embryologists, reproductive medicine specialists/infertility specialists, gynaecologists, andrologists, obstetricians, and clinical counsellors/patient counsellors. Furthermore, the researcher obtained consent from prospective parents and doctors to record their interactions during the study. The researcher also made daily observations of the hospital settings, which were recorded for further analysis. The details of the socio-economic profile of prospective mothers are summarised in Table 3.

Table 3: Socio-economic Profile of Respondents (prospective mothers)

Socio-economic Characteristics	Categories and Number of Respondents				Total
Age (in years)	(25-30)-15	(31-35)-13	(36-40)- 2	(Above 40) - 2	32
Religion	Hindu-26	Muslim-4	Christian- 2		32
Caste	Upper- 18	OBC-13	SC-1		32
Education	Up to 10 th -3	12 th equivalent- 5	UG- 17	Master and Higher- 7	32
Occupation	Homemaker-18	Teaching and Informal-6	IT and Corporate-6	Self-Employed- 2	32
Personal Income	Nil -18	Below Rs. 5 lakh - 6	Rs. 5-15 lakh – 5	Rs. 15 lakh and above- 3	32
Family Income	(Below Rs. 5 lakh)- 6	(Rs. 5-10 lakh)- 9	(Rs. 10-20 lakh)-10	(Rs. 20 lakh and above)- 7	32
Married Period	Less than 2 years- 3	2-5 years- 6	6-10 years-16	Above 10 years- 7	32
Marriage Type	Endogamous-13	Consanguineous- 11	Inter-caste- 5	Interfaith- 3	32

Thirty-two prospective mothers undergoing IVF assistance participated in this study who are in different stages of their treatment. The age range of the respondent mothers varied from 26 to 48 years, with an average age of 35. Among the participants, twenty-six identified as Hindu, four as Muslim, and two as Christian. These women also belonged to diverse caste groups, with eighteen from the upper caste, thirteen from OBC, and one from the Schedule Caste (SC). In terms of education, seventeen of them completed their undergraduate in both technical and non-technical fields, while three had only attended school. The remaining seven women had pursued higher education, with five completing up to twelve standards. Most of the women, eighteen in number, were homemakers at the time of the interview.

Among them, some had never worked for any paid job, while others had left their jobs after marriage or upon starting IVF treatment. Additionally, six women were employed in the IT sector, and another six worked as teachers or in informal positions. Two women were

successful entrepreneurs managing their businesses. Most women interviewed were housewives, so they did not have individual income sources. However, six women reported an annual income below five lakhs, five earned between five to fifteen lakhs per annum, and three earned more than fifteen lakhs annually.

Regarding family income, six women had a yearly income below five lakhs, nine between five to ten lakhs, ten between ten to twenty lakhs, and seven reported an income above twenty lakhs. Regarding marital status, sixteen women had been married for six to ten years, followed by seven who had been married for ten years, six for two to five years, and three for less than two years. Moreover, sixteen women had endogamous marriages, eleven had consanguineous marriages, five had inter-caste marriages, and three had inter-faith marriages. The study included men from various age groups, each with distinct social and economic profiles, as presented in table 4 below:

Table 4: Socio-economic Profile of Respondents (prospective fathers)

Socio-economic Characteristics	Categories and Number of Respondents				Total
Age	(Below 30)-5	(30-35)-8	(36-40)-2	(Above 40) - 5	20
Religion	Hindu-19	Muslim-1	Christian- 0	Others-0	20
Caste	Upper- 9	OBC-10	SC-1	Others-0	20
Education	(Up to 12 th) - 2	(UG technical)-3	(UG-nontechnical)- 7	(Master and Higher)-8	20
Occupation	(IT and Corporate)- 7	(Government)-2	(Non-government and Informal)- 6	(Self-Employed)-5	20
Personal Income	(Below Rs. 5 lakh)- 2	(Rs. 5-10 lakh)- 9	(Rs. 11- 20)- 5	(Above Rs. 20 lakh)-4	20
Family Income	(Below Rs. 5lakh)- 2	(Rs.5-10 lakh)- 10	(Rs.11-20 lakh)-5	(Above Rs. 20)- 3	20
Married Period	(Less than 2 years)- 1	(2-5 years)- 8	(6-10 years)-8	(Above 10 years)- 3	20
Marriage Type	Endogamous-9	Consanguineous- 9	Inter-caste- 2	Interfaith- 0	20

Twenty prospective fathers participated in the study. Sixteen were interviewed with their spouses, while three prospective fathers were interviewed individually. The interviewed prospective fathers' age range varies from twenty-three to fifty-five years. Prospective fathers were interviewed at the hospital when they accompanied their wives to the fertility centres. Some of them had already undergone surgeries as recommended by doctors before their wives started IVF, while others contributed to the IVF process by providing sperm. Most of the men interviewed supported the IVF process financially, emotionally, or morally as a partner due to

social pressure, fulfilling moral responsibility, or out of mutual understanding (Chapter five of the thesis discusses the details of these prospective fathers). Among them, five participants were below thirty years old, eight were between thirty and thirty-five years old, two were between thirty-six and forty years old, and five were above forty years old.

Regarding religion, nineteen participants followed Hinduism and one identified as Muslim. Regarding caste representation, nine participants belonged to the upper caste, ten were from the Other Backward Class (OBC), and one belonged to the Scheduled Caste (SC). Among the prospective fathers, two had completed education up to 12th standard, three had pursued Undergraduate (UG) technical courses, seven had completed Undergraduate (UG) non-technical courses, and eight had attained Master's or higher degrees. Occupations of the prospective fathers varied, ranging from IT and corporate fields to government jobs and informal and private businesses. Among the twenty participants, seven were employed in IT and Corporate sectors, two were in government jobs, six were engaged in non-government and informal occupations, and five were self-employed. While most prospective fathers supported their families financially, some also received support from their wives or extended family. Two participants had a personal income below five lakhs per annum, nine earned between five to ten lakhs annually, five earned between eleven to twenty lakhs annually, and four earned above twenty lakhs annually.

Similarly, two participants came from families with an annual income below five lakhs, ten had a family income ranging from five to ten lakhs per annum, five had a family income between eleven to twenty lakhs per annum, and three had a family income above twenty lakhs annually. Regarding marital status, one participant had been married for less than two years; eight had married for two to five years, eight had married for six to ten years, and three married for more than ten years. Out of twenty men, nine participants had an endogamous marriage, nine had a consanguineous marriage, and two had an inter-caste marriage, with no participants having an interfaith marriage.

Table 5: Profile of Respondents (medical practitioners)

Serial No	Areas of Specialisation	Year of Experiences
1	Gynaecologist and Obstetrician (Infertility Specialist)	25 years in general and 15 years as a specialist.
2	Infertility Specialist and Medical Director	18 years of experience.
3	Embryologist (PhD)	22 years of experience in ART.
4	Gynaecologist and Obstetrician (Infertility Specialist)	More than 35 years of experience in general and 22 years of experience in ART.
5	Gynaecologist and Obstetrician (IVF Specialist)	26 years of experience.
6	Reproductive Medicine Specialist (Clinical et al. Consultant)	More than 10 years of experience in ART services.
7	Andrologist	10 years of experience.
8	Reproductive Medicine and IVF Specialist	11 years of experience
9	Managing Director of a fertility Centre, Legal Officer, and Patient counsellor	More than 35 years of experience.
10	Genetic Specialist (PhD)	9 years of experience.
11	Consultant Psychologist (PhD and specialised in Reproductive Counseling)	14 years of experience.

Eleven medical professionals specialising in different areas related to infertility treatment and assisted reproductive technology were interviewed for the study. The experience of each specialist varies, ranging from nine years to more than thirty-five years. The areas of specialisation include Gynaecologists and Obstetricians focusing on infertility, IVF (In Vitro Fertilization) specialists, Embryology, Andrology (related to male reproductive health), Reproductive Medicine, and Genetic Counseling. Specialists with PhD degrees are present in Embryology and Genetic Counseling. Some professionals hold medical or clinical director positions in fertility centres, indicating leadership roles in their respective domains. Their collective experience and expertise make them valuable resources for individuals and couples seeking ART and reproductive counselling assistance. Medical professionals play a significant role in shaping prospective parents' reproductive choices and contribute to the legitimisation of IVF technology. Chapter six of this thesis delves into the detailed exploration of how knowledge, technology, and reproductive choice are co-constructed within this context. It examines the intricate relationship between professionals, technology, and individuals' decision-making processes regarding assisted reproductive methods.

Methods and strategies: Reflexive thematic analysis

In this segment, the study delves into the methodologies and strategies employed for data analysis. The research used the thematic analysis (TA) model, conceptualised by psychologists Virginia Braun and Victoria Clarke. Introduced in 2006, the thematic analysis model aimed to

establish a structured approach for building themes in social sciences (Mihas, 2023). Over time, this model evolved into what is known as reflexive thematic analysis (RTA), characterised by a more introspective stance in the data analysis process (Clarke et al., 2021). Thematic analysis entails a methodical examination of themes derived from data collected across various locations within the study area. Reflexive thematic analysis (RTA), on the other hand, is recognised as an adaptable technique employed to find out the construct patterns within a qualitative dataset (Clarke et al., 2021, p. 4). Beyond merely drawing from interview data, reflexive ethnography encompasses the researcher's personal experiences, existing knowledge, and societal standpoint. RTA goes a step further by critically scrutinising how these elements collectively shape and influence the researcher's approach, thereby shedding profound insights on the qualitative data (ibid: 5). The present study embraces Braun and Clarke's RTA approach to dissect its data, which is contextually grounded in the interactions between the researcher and the dataset. This chapter elucidated an in-depth exploration of the researcher's reflective process, elucidating the theme development process in data analysis.

Familiarising with the dataset

Reflexive TA has six phases, from gathering data to making a research report. The first stage of reflexive TA is 'familiarising research with the dataset.' The researcher tried to familiarise the dataset's content in this initial stage through immersion. The transcripts used for the study were repeated interviews with respondents, including prospective mother, prospective father, medical practitioners, interactions with paramedical staff, doctor and patient interaction, recording of informal conversation of researcher with respondents, observation from field sites such as advertisement poster, etc. In this immersion process, the researcher read and re-read transcripts of interviews, listened to recordings a few times, and started making notes about the basic ideas the research has in the broader area of science and technology studies.

Semantic and latent code

The second stage is 'coding,' where the researcher identifies a data segment that appears potentially interesting, relevant, or meaningful to the research questions. Transcripts of each actor were kept separated from which initial codes were developed. These initial codes are then assigned some meaning descriptions or code labels. Following reflexive TA, all the codes were developed from a range of levels, i.e., 'from a very explicit or surface meaning,' i.e., from 'semantic' code to more conceptual meaning is called 'latent' (Clarke et al., 2021). The semantic codes developed for prospective mothers includes emotions such as anxiety, fear, guilt, anger,

frustration, uncertainty, desire, and hope; bodily experiences such as pain, satisfaction, suffering, gaining weight, mood swing, and procrastination; knowledge of IVF such as unnatural, natural, hope technology, uncertainty; choices such as family and peer group pressure, financial support, financial burden, experiencing motherhood, own child, age, time, foreign body, donor egg and donor sperm, choice-lessness, support, morality, career, faith, culture, negotiation etc. Semantic codes further developed into latent codes such as patriarchy, normative principle, moral agency, embodiment, normalising pain, uncertainty and hope, sociocultural relation, power dynamics, biological autonomy, gender identity, reproductive capability, embodying motherhood, and everyday challenge. These code labels were developed systematically and through the reading of transcripts, which compile the relevant data segment for each code.

The semantic codes developed by prospective fathers vary from emotions to relationships concerning scientific beliefs. These codes include financial burden, superstition, hope, blaming the insurance company, blaming wife, blaming oneself, family pressure, fear of losing the job, worried for wife's health, family, own child, fear of uncertainty, blaming the medical system, technology as hope, IVF and secret treatment, honour, family respect, morality, knowledge, technology knowledge, money, faith on the doctor, sympathy for women's bodily pain, concern for wife's motherhood status and her position in the family. These codes are further developed into latent codes such as men and reproduction, reproductive choice and masculinity, uncertainty and hope, family honour, moral dilemma, and donor insemination.

The semantic codes derived from the interview of doctors and other medical practitioners are such as blaming patients for their sedentary lifestyle, advanced and best technology, the importance of motherhood, having their own child, married women and giving birth to their own child, painless procedure, IVF as natural, IVF assisting pregnancy, IVF a solution, sympathy for infertile women, IVF is natural, donor option is normal and natural, importance for a woman to become a mother, advanced IVF such as the use of Intracytoplasmic sperm injection (ICSI), Pre-implantation genetic diagnosis (PGD) helps in identifying disability in unborn embryo, ethical practice, informed consent, etc. All these semantic codes were developed into the latent code, such as defining one's own child, abled-bodied person, medical model, social model, eugenised embryo, infertility stigma, gendering reproduction, normalising IVF practice, heteropatriarchal ideology, hope, credibility, etc.

Transcripts collected from advisement posters used for marketising IVF, market observations from the field, etc., transformed into semantic code such as parenthood dream, miracle of motherhood, family, and donor treatment. The latent code developed from this is the market model heteropatriarchy. Similarly, the primary data collected from the government reports print media are developed into codes such as sympathy for mothers, medical service, business, market expansion, profit, and regulation. These codes are developed into latent codes such as regulatory agency, heteronormative principles, rationality, constructing choice, etc.

Developing themes

In the third phase of the coding process, which involves generating initial themes, the researcher identified a common pattern that imbued meaning across the entire dataset. The researcher grouped clusters of codes that shared a central idea or concept of decision-making and socio-technical relationships in everyday practice, effectively addressing the research questions. After pinpointing potential themes that addressed these research questions, the researcher collated all the coded data under each 'candidate theme' or 'initial theme' (ibid).

The initial themes that emerged from the narratives of prospective mothers revolved around their decision-making processes and the socio-technical practices related to IVF technology in their daily lives. These initial themes encompassed topics such as *choosing IVF for achieving motherhood, moral agency and the decision to undergo IVF, addressing biological limitations through technological assistance, navigating the experience of motherhood while normalising pain, and integrating IVF into the journey of conception*, among others. Similarly, a distinct set of initial themes emerged when analysing the interviews with prospective fathers. These themes included *the financial burden and the choice to pursue IVF, family honour and the discreet consideration of IVF as an option, moral agency and the supportive role played in the IVF reproductive journey, blaming women and concealing male ego, and negotiating masculinity for societal status within the context of IVF treatment*.

Furthermore, the initial themes that emerged from analysing state regulation reports, marketing advertisements, doctor interviews, and interactions with paramedical staff centred around different aspects of IVF technology. These themes included *normalising patriarchy through the promotion of IVF, constructing IVF as a technology of hope with gendered implications, glorifying motherhood as a means to marketise the technology, emphasising profit in the proliferation of IVF, regulating technology while reinforcing patriarchal norms, and*

highlighting disparities in access to assisted reproductive technology, thereby reinforcing heteropatriarchy.

The fourth phase of reflexive TA is 'developing and reviewing themes.' Under this phase, the researcher recursively reviewed all the candidate themes related to the entire data set and coded data items (Braun & Clarke 2006, 2017). This review process involved finding a compelling story that the candidate themes making about choices, agency, power, resistance, confirmation, non-confirmation, etc., in this research that developed a pattern of shared meaning related to the dataset (ibid). These themes highlighted a pattern across the dataset concerning the research question, i.e., how various actors play their roles in the IVF network, interact in the IVF network, and make decisions in various stages of IVF. During this procedure, certain themes were revised and divided into two or more themes, and a few were discarded. In this review, the characters of each theme were identified concerning the broader context of the study of assisted reproductive technology and IVF, using the science and technology studies (STS) perspective. The reviewed themes developed from a similar pattern found among all the actors of IVF network studies in this context.

The predominant theme that emerged consistently in the narratives of individual actors and non-human entities such as the state, media, market, and IVF technology is the concept of 'choice.' The decisions made by various actors played a fundamental role in shaping the meaning associated with the creation of life in a laboratory through the assistance of technology. Within the socio-technical landscape of IVF, this technology is often characterised as both a 'hope technology' and a 'technology of uncertainty.' Throughout the journey of IVF, individual actors engage with the technology in a manner that includes acceptance, resistance, and modification. However, the exercise of agency to accept, challenge, resist, or adapt innovations in assisted reproductive technologies within the IVF network occurs non-linearly, stemming from responses on different fronts.

In IVF practice, the linear trajectory is disrupted, giving rise to an assemblage of socio-technical elements within a network relationship. At times, individual users, including prospective mothers, fathers, and medical practitioners, adapt their use of this technology based on the specific characteristics of the direct users' bodies or to improve success rates through the incorporation of advanced techniques like ICSI or PGD, among others. In some instances, this technology has the potential to reshape established social and cultural norms surrounding natural conception through intercourse, as it introduces the concept of creating 'life' or embryos

in a laboratory setting outside the human body. The choices made by different actors within the IVF network are subject to negotiation within a space where networks evolve through repeated actions. Through these negotiations, driven by the pursuit of motherhood, fatherhood, the preservation of family honour, moral decision-making, etc., all actors within the IVF network operate not as isolated entities but about one another, contributing to the network's stability.

As a result, this research's notion of 'agency' extends beyond the traditional individualistic perspective of *ego cogito*, where actions solely impact one's life. All the themes and concepts derived from the narratives express that agency exists within the context of relational dynamics among actors within the IVF network. Consequently, all the central themes developed for the chapters have been reassessed in light of this central concept of 'agency,' which serves as the core organising principle of this work.

In the fifth phase of the process, candidate themes underwent a thorough review. These themes were meticulously refined, precisely defined, and assigned appropriate names during this stage. Within this phase, concise synopses were crafted for each theme, aligning with their respective theme names. These synopses were not static but evolved through several review iterations to enhance the thematic development of the research questions. By moving into the sixth and final data analysis phase, the focus shifted toward compiling a comprehensive 'write-up.' While formal analytical writing commenced in the third phase, coinciding with the inception of initial themes, traces of informal writing had already surfaced as early as the first phase. This initial phase involved familiarising oneself with notes and engaging in reflexive journaling, which gradually transitioned into a more structured writing approach. In the final stage, the formal writings of the developed themes intertwined with the researcher's knowledge developed from the broader area of science and technology studies.

Researcher and the field: Reflections

The researcher's interest in the topic emerged from her acquaintance with the emerging technology in the medical field and the philosophical questions she grappled with regarding medicine and medical technologies. This research journey began in 2015 when the researcher embarked on her PhD. Quite serendipitously, the researcher stumbled upon surrogacy—a sociological study—due to the intense media coverage surrounding its regulatory issues, both nationally and internationally. This was a period when the concerns and complexities related to surrogacy, particularly the well-being of surrogate mothers, deeply resonated with the

researcher as a woman and a keen news consumer. Although the researcher had already completed an MPhil in Sociology, she decided to enrich her knowledge further by auditing select coursework in the Department of Sociology at the University of Hyderabad. By 2016, supplied with a more comprehensive understanding of the subject, the researcher crafted a well-defined research proposal by engaging with numerous scholarly works on surrogacy and assisted reproductive technologies. The researcher began to develop expertise in the field of specialisation - Science and Technology Studies (STS). STS as an area of research within the sociology discipline was introduced to the researcher by her PhD supervisor. As guided by her PhD supervisor, the specialisation of STS provided a new dimension to understanding human-technology relations in a non-binary way.

Taking a proactive approach, the researcher ventured into the field by identifying hospitals and clinics engaged in commercial surrogacy. The researcher's exploration led her to the Indian Medical Association (IMA) in Koti, Hyderabad, intending to obtain contacts for fertility centres involved in surrogacy and assisted reproductive technologies. Engaging with the personnel at IMA, the researcher found an individual 'P' (pseudonym) who took a genuine interest in the present work. Ms P recognised the significance of the research and showed eagerness to support the researcher's endeavours. Expressing her appreciation, she referred the researcher to a contact, Ms Q (pseudonym), an employee of 'The Obstetric and Gynaecological Society of Hyderabad located in Himayat Nagar. Ms. P from IMA encouraged the researcher to contact Ms. Sirisha, mentioning her name as a reference for further collaboration and insights. This initial interaction marked the beginning of a journey fuelled by both personal passion and academic curiosity, propelling the researcher toward a deeper exploration of the sociological landscape surrounding surrogacy and assisted reproductive technologies.

A sociological study on IVF

Between the years 2016 and 2017, the researcher's interest in the realm of high-tech medical equipment was significantly stimulated. The researcher's encounters with technological advancements such as robotics treatment kindled this fascination. While the researcher's curiosity initially leaned toward studying robotic technologies, she found herself increasingly drawn to exploring the interplay between medical technologies and the various stakeholders in the medical field—medical practitioners, patients, or other associated actors. By being immersed in the literature study on reproductive technologies, specifically assisted reproductive technologies (ARTs), the researcher was naturally inclined to continue the

research in this domain. Unfortunately, the researcher could not conduct fieldwork in 2016 for health reasons. Nonetheless, the researcher dedicated this time to an extensive review of pertinent literature and began shaping a semi-structured interview schedule.

During this period, a pivotal development occurred with the passage of the 'Surrogacy Regulation Bill 2016' in the Lok Sabha. This legislation effectively curtailed the practice of commercial surrogacy in India, reserving the avenue of altruistic surrogacy solely for heterosexual married couples who had been married for a minimum of two years. The bill also imposed bans on foreigners, heterosexual couples, and single parents seeking to engage in commercial surrogacy. These regulatory measures reverberated across India, including Hyderabad, where numerous surrogacy clinics had proliferated. The repercussions were not confined solely to fertility clinics and medical practitioners; even aspiring parents found themselves constrained from sharing commercial and altruistic surrogacy information. While the latter practice was rarely observed, its description within the regulation bill remained vague. This confluence of events introduced a unique landscape of uncertainties and anxieties within the surrogacy realm, prompting a critical examination of the prevailing dynamics.

To gain access to local surrogacy centres, the researcher revisited the Indian Medical Association (IMA) located in Koti. IMA showed reluctance to provide any information related to commercial surrogacy. The staff of IMA pointed out the recent passage of a new surrogacy bill in the Lok Sabha, emphasising that conversations about surrogacy, especially on the commercial front, had become notably sensitive. During this visit, Ms. P advised the researcher to seek assistance from Ms. Q at the Obstetrics and Gynaecology Society. Following this recommendation, the researcher proceeded to the Obstetric and Gynaecological Society situated in Himayat Nagar, Hyderabad, where the researcher had the opportunity to meet Ms Q. She candidly shared her perspective on the prevailing state of Surrogacy centres within the city.

According to Ms. Q, it is important to acknowledge that a covert practice of commercial surrogacy occurs behind closed doors. The recent passage of the new bill in the Lok Sabha has instilled a heightened awareness, leading to a reluctance to discuss the subject openly. Undoubtedly, this new bill has already exerted an impact on the landscape. Anticipating its eventual transformation into an ACT through parliamentary approval, many practitioners have become restrained, anticipating its potential implications. Given these circumstances, it is

unlikely that individuals will readily divulge information about surrogacy practices. This is further complicated by the presence of unethical practices in some instances.

Ms Q elaborated: *While our efforts are directed towards engaging with these practices, locating and regulating every entity involved remains practically unfeasible. This is not within our purview nor our capacity. Our focus primarily centres on maintaining ethical standards within the realm of medical technology. Notably, our regulatory measures apply to members of our association. The association called Federation of Obstetric and Gynaecological Societies of India (FOGSI) organises numerous seminars yearly, often emphasising advancing women's well-being. It is paramount to underline that our core concentration revolves around enhancing maternal health.* This insight provided by Ms. Q offered a glimpse into the complexities of the surrogacy landscape, shedding light on the challenges faced by regulatory bodies and practitioners alike in ensuring ethical practices while contending with a changing legal framework.

Through the fieldwork experiences, the researcher realised that commercial surrogacy persisted even though the transformation of the surrogacy bill into an Act was pending. In contrast, altruistic surrogacy remained an infrequent occurrence. In this uncertain landscape, the researcher realised it was necessary to redirect the research focus due to time constraints. Leveraging the substantial familiarity with the literature on assisted reproductive technologies (ARTs), particularly in vitro fertilisation (IVF), the researcher resolved to delve into a sociological examination of IVF technology. With the approval of the research guide, the researcher initiated a study into the socio-technical dimensions of IVF. To gather data for this new research avenue, the researcher revisited the Indian Medical Association (IMA) in Koti. While procuring a list of registered IVF clinics was challenging, the researcher obtained an official list of all registered hospitals in Greater Hyderabad. This process involved a payment of Rs. 1,332/-, for which a duly acknowledged receipt was received. This comprehensive list provided key details, encompassing the names of managing directors, addresses, and contact particulars. From this pool of 1332 hospitals, twenty fertility centres were randomly selected and actively engaged in ARTs, with a specific focus on IVF.

In June 2017, the researcher commenced communication with these twenty selected fertility centres through email. The research topic was introduced in these correspondences, and a reference letter from the PhD supervisor was produced alongside a consent form attested by the PhD supervisor. However, the initial responses could have been more varied, with the first

two replies trickling approximately six months later, around April 2018. Following this turning point, the researcher visited the fertility centres to understand the field. During these visits, the medical practitioners were open to engagement, permitting the researcher to pose questions and even suggesting the possibility of distributing a questionnaire if she possessed one. Following this initial visit or pilot study was conducted through which the researcher started making contacts with the prospective mothers and fathers seeking IVF. It was observed from the pilot study that many fertility centres run independently within their ownership. These centres' owners and founders are mostly specialised gynaecologists, obstetricians, and IVF specialists. Only some IVF specialists run separate departments within larger multi-specialty hospitals.

Several fertility centres contacted by the researchers permitted them to engage with doctors and administrative personnel. However, these centres prohibited the researchers from interacting with the prospective mothers and fathers seeking IVF services, whom they referred to as their patients (IVF users), due to their commitment to maintaining strict confidentiality policies. In the meantime, a Fertility Centre named 'A' (pseudonym) responded and allowed the researcher to speak to their patients with their consent. This fertility centre is situated in Hyderabad's High-tech City. This hospital, self-proclaimed as a premier fertility centre at national and city levels, prominently showcased the recognitions and honours certificates, including achievements of its medical practitioners, on its website's homepage. These awards were a testament to their legitimacy of utilising cutting-edge reproductive technologies. Before making an in-person visit, the researcher thoroughly scrutinised the hospital's official webpage. The correspondence was furnished with the contact details of the marketing manager, Ms. S (a pseudonym). The initial contact was made with the marketing manager, Ms. S, to schedule an appointment with the designated doctor at the hospital. Adhering to the data provided by Ms. Q, the researcher attended the hospital for the scheduled appointment as arranged. After the initial two months of a pilot study and the development of good rapport with a few prospective parents, formal interviews were taken from June 2018 to October 2019. In the meantime, the researcher also visited other fertility centres to conduct interviews with IVF medical practitioners engaged in IVF treatment. However, Fertility Center 'A' posed many restrictions to the researcher to reach their clients, limiting the quality of interviews of respondents' parents seeking IVF treatment. In order to fill this gap, more interviews were conducted outside the fertility centres, mainly in respondents' homes, following a snowball sampling to find the next respondents.

In December 2019, another fertility Centre named 'B' (pseudonym) allowed researchers to interview their clients seeking IVF. Fertility Center B's doctors and hospital staff were hospitable and friendly, making the researcher feel more comfortable doing her fieldwork than the previous Fertility Center A. The waiting for Longue of Fertility Centre B had many similarities with Fertility Centre A in the sense of exhibiting reward and recognition certificates, customer reviews, and television with few pieces of advice for their clients seeking parenthood journey. Displays of many aesthetic portrayals of the Hindu God and Goddess in every corner and entrance of Fertility Centre B are unique and different from other centres visited by the researcher. Most respondents interviewed in Fertility Centre B related their hope and belief in doctors and admiring this aesthetic portrayal of religious symbols, associating them with positivity and certainty. Fieldwork persisted at the Fertility Centre until March 2020, concluding the practice of conducting interviews within the physical premises of the fertility centre due to the onset of the COVID-19 pandemic. Despite the challenge, a few second or third-round interviews were done over a telephone conversation.

A description of hospitals (physical space)

The fieldwork commenced with a visit to the Neonatal Intensive Care Unit (NICU), preceded by a tour of the labour room. In the NICU, the researcher encountered two newborn twins receiving care on ventilators. Interestingly, their mothers were still recuperating on a stretcher in the operating theatre, visible through a window connecting the two areas. The Public Relations Officer from Fertility Centre- A said that these newborns had been born prematurely and were grappling with breathing difficulties, rendering them rather fragile. Consequently, they required intensive care within the NICU for their treatment. During our brief visit, the Public Relations Officer also gestured toward a group of other infants undergoing photography as they had been diagnosed with jaundice. Due to time constraints and limited access, we spent approximately 10 minutes inside the NICU before concluding our visit. The Public Relations Officer introduced the researcher to several fertility centre staff members. The researcher was then allowed to see the inside view of the labour room from the labour window, where a few women were seen resting in the bed, and a few were already taken to the stretcher.

Like the labour room and NICU hospital, the patient waiting lounge is a significant hospital space. The hospital waiting lounge is a shared space where individuals seeking treatment converge, interact, and exchange their experiences; a dynamic of disassociation becomes apparent. For many women arriving for treatment, comfort takes precedence in their attire,

often wearing sarees or churidars (long kurtas with loose trousers). Given the prevailing association of motherhood with married women in South Asian countries, particularly in India, married Hindu women often adorn themselves with bangles, *mangalsutras* (a marital necklace), vermilion, and toe rings as symbols of their marital status. As the researcher does not wear these items, she stands out to many as unmarried, prompting some to detach themselves from the researcher.

Since the societal framework places the expectation of giving birth primarily upon married women at a standard age, the researcher's presence prompts certain assumptions. Some women would ask why the researcher was not displaying traditional marriage symbols like *sindoor* (vermilion) or toe rings. These markers held significance because married women in their communities typically adorned themselves with these symbols. Frequently, by observing the absence of these symbols, they would deduce that the researcher was unmarried. Conversely, some respondents believed the researcher was married and questioned why she was not wearing these symbols. As they learned more about the researcher, they understood that she was neither married nor under societal pressure to have children. This realisation, combined with the researcher's educational background and English-speaking abilities, made them perceive her as part of a more empowered and educated group. This contrasted with their situation, where the societal pressure to give birth was palpable, influencing their demeanour and outlook. The confidence the researcher exuded due to the lack of such pressures made her stand out in respondents' eyes.

There was an incident where a woman seated beside the researcher assumed that the researcher was married and visiting the clinic for fertility-related treatment. She glanced at the researcher's feet and inquired, *why are you not wearing toe rings? Aren't you aware that they contribute to reproductive health improvement? My mother emphasised that all married women should wear toe rings.* In response, the researcher clarified her unmarried status and explained that she was at the hospital for research purposes. This revelation shifted her focus from the researcher's marital status to her research topic and PhD pursuits. This interaction illustrates a familiar pattern where the researcher was perceived as "other" —an individual who resides outside the bounds of their perceived collective group.

Consequently, these female respondents regard the researcher as a woman of privilege due to her unmarried status, financial independence, and comparatively higher level of education. This amalgamation of factors makes them presume that the immediate pressure of childbirth

unburdens the researcher. Likewise, female doctors predominantly perceived the researcher as an enthusiastic individual with a distinct field of interest, considering her an outsider whose area of focus differed from the conventional medical realm of IVF practice.

How did female respondents associate them with the researcher?

Although female respondents, mainly the prospective mothers, see the researcher as an outsider regarding her marital status, other grounds like age, clothing patterns, and the researcher's ability to establish a good rapport with women helped prospective mothers get comfortable during interviews. Upon knowing the marital status of the researcher, some female respondents showed concern about the researcher's marriage, and few advised the researcher to get married and have a child to avoid the difficulties they are experiencing in giving birth to a child as the researcher has entered the age group of thirty.

This curiosity typically arose when the researcher interacted with women, particularly in the waiting lounge. Patients receiving IVF treatments or other related technologies would converse in this common space. Many of these women came alone due to the cultural expectation that husbands serve as primary breadwinners, preventing them from taking time off work. It was remarkable to see women who had seldom ventured out of their homes arriving alone for treatments, highlighting their strong desire to overcome hurdles and undergo the treatment.

Conversations often spark when the researcher wears a long *kurta* (A long loose dress worn by South Asian women), which lends the researcher an appearance of maturity, even though most respondents know that the researcher is a PhD student at the University of Hyderabad. The researcher blended well due to her age aligning with the average age of prospective mothers in their community. Instead of entering the field with preconceived assumptions, the researcher aimed to allow the respondents to shape the direction of the study. This approach explored how they perceived and defined various elements of the IVF network and how they constructed their social and natural reality. Crucially, how they imbued everyday interactions with IVF technology with personal meaning was understood.

Female respondents, including medical practitioners and paramedical staff, viewed the researcher as a woman already in her marital and reproductive age. Occasionally, certain hospital staff members, such as embryologists or genetic specialists, advised the researcher to complete her PhD and consider starting a family sooner. They perceived the challenges associated with childbirth for women at a later age. During a lunchtime conversation with some junior doctors and hospital staff at Fertility Center A, one of them inquired, "How old are you?"

When do you plan to complete your PhD? I finished my PhD in Australia within three years of registration, and I am married with two children. Since you're already in your thirties, you should aim to complete your Ph.D. quickly, secure a job, get married, and start your family."

Researchers' engagement with male respondents

The study involved male respondents, including prospective parents and medical practitioners. Compared to female respondents, the number of male respondents is less. Unlike female respondents, it was more challenging to interview males who were choosing IVF either for male or female infertility. Male individuals accompanying their spouses to medical facilities for female infertility issues found it comparatively more convenient to engage with the researcher when assuming a supportive role in the reproductive context rather than being the primary participant in infertility treatment. Notably, most male respondents, designated as prospective fathers, established a connection with the researcher during subsequent interactions, allowing for in-depth discussions on their knowledge of various facets of in vitro fertilisation (IVF) treatment. These discussions encompassed scientific and technological aspects, as well as considerations related to government regulations governing the utilisation of IVF technology and the potential incorporation of IVF treatments into medical insurance coverage. However, it is noteworthy that as the researcher developed a rapport with prospective parents, there was an observable shift towards expressing emotional experiences endured during the IVF procedure, with individuals gradually sharing their vulnerabilities discreetly. In contrast to prospective mothers, prospective fathers tended to be less expressive of their emotions, and some engaged in shorter conversations during their interviews. Like female medical practitioners, male medical practitioners maintained professional behaviour when interacting with the researcher.

Limitations of the study

The study primarily focuses on the limited urban market space where IVF technology is prevalent due to its high cost, catering mainly to individuals who can afford the treatment. This research explicitly examines those already engaged in the IVF cycle, which implies that the study targets individuals with the financial means or the willingness to bear the high costs associated with this treatment. These individuals, known as commissioning or prospective parents, bear various physical, emotional, financial, and societal burdens as they undergo IVF technology. However, it is important to note that IVF technology remains inaccessible to those who need help to afford the expenses or lack awareness of its existence. The study's scope is

confined to those actively participating in IVF procedures due to limitations in time and resources. It does not investigate the broader inequalities introduced by this technology in human reproduction. Furthermore, the research is geographically limited to the Greater Hyderabad area.

The study's sample selection is purposeful and based on a preliminary pilot study. Notably, during data collection, no prospective parents from the LGBTQ+ community were found undergoing IVF treatment. Therefore, all individual respondents interviewed in the study are heterosexual married men and women. Respondents primarily belong to social groups such as Brahmin, Reddy, Kama, Komati, Kapu, Padmashali, Vaishya, Jangam, etc. Most hesitated to provide specific details about their caste and religious sect and only disclosed their broader social categories. As a result, the respondents' social backgrounds are categorised in this thesis as general, OBC, or SC. No individuals with physical or mental disabilities were encountered during fieldwork.

Ethical consideration

Throughout the thesis, utmost care is taken to protect the anonymity of all respondents, including medical practitioners, prospective fathers, prospective mothers, and individuals dealing with infertility. The research is conducted in a non-invasive manner, and data collection is carried out discreetly. Various techniques are employed for data gathering, including face-to-face informal interactions and in-depth interviews conducted using semi-structured interview schedules. It is important to note that all interviews are conducted with the explicit consent of the individual respondents. While the majority have provided oral consent, a few have chosen to formalise their consent by signing the consent form given by the researcher.

The research follows ethical guidelines and has received ethical permission from the Institutional Ethical Committee (IEC) affiliated with the School of Medical Science at the University of Hyderabad. Additionally, during the initial stages of fieldwork, including the pilot study, individual respondents were approached with a consent form duly signed by the researcher and the PhD supervisor, bearing the department seal. Besides, a reference letter from the PhD supervisor was also produced before the respondents. It is ensured in the study that all participants were fully informed and willingly agreed to participate.

CHAPTER THREE

DEVELOPMENT OF IN VITRO FERTILISATION: INTERSECTING SCIENCE, TECHNOLOGY, AND SOCIETY

Introduction

In vitro fertilisation, popularly known as IVF, was first experimented on humans in the 1970s in the United Kingdom. The purpose behind the development of this technology was to assist women in conceiving in case the fallopian tubes are blocked or damaged. This initial development of IVF technology to assist infertility treatment was known as conventional IVF. The use of IVF technology nowadays is extended to design a baby by controlling the physiological look of the pre-implanted embryo. Recently, IVF technology has been helping to avoid or prevent the transformation of any mitochondrial diseases from genes to the prospective child.

Along with the fallopian tube blockage/damaged problem, today, IVF is used to solve the enormous difficulty prospective parents face in conceiving. This new development in the IVF network is popularly known as advanced IVF technology with the development of assisted reproductive technologies (ARTs hereafter) like preimplantation genetic screening (PGS), preimplantation genetic diagnosis (PGD), intracytoplasmic sperm injection (ICSI), frozen embryo transfer (FET), donor treatment, etc. The 'new' IVF treatment differs from the conventional IVF in that the latter technology helped to cure infertility issues women face due to fallopian tubal blockage. In contrast, new IVF technologies 'design' the prospective child according to their skin colour and pre-diagnosed genetic disease. The child born through the advanced form of IVF technologies is popularly known as the 'designer baby.' The later development of the IVF network has raised ethical, social, and political importance, and the debate and discourse on its use are highly contentious.

Today, when IVF technology is widespread across the globe, and its use is normalised in the guise of the capitalist market, it is essential to understand the logic and origin of this technology to understand its practice better in the present society. How did this technology originate under which social scientific circumstances? Exploring the origin of IVF would enable us to understand how, historically, life construction is understood and interpreted by scientists and what effect it has in the present context of the IVF practice. The purpose of this chapter is not

to bring out the contestation around this technology, as it is already discussed in chapter one. Instead, this chapter aims to discuss the ontology and epistemology of IVF technology. The objective here is to critically discuss how discoveries at various historical epochs led to distinct interpretations and reinterpretations about the genesis of life and how humans finally succeeded in 'constructing' life *in vitro* in the laboratory. It also aims to interpret the paradigm shifts in science and engineering by accumulating various forms of knowledge and developing multiple tools.

Instead of doing a chronological and periodical description of the development of embryonic research and the meaning associated, this chapter follows a thematic analysis of resulting narratives from the history of embryonic development and its control during different historical paradigms. The concept of paradigm is borrowed here from Thomas Khun's 'paradigm shift' (Kuhn et al., 2012). The latter referred to the fundamental changes within a scientific discipline in its existing theories, assumptions, and methodologies required to develop scientific innovation. Kuhn's approach developed in the criticism of a linear process of science and scientific innovation. Beyond the deterministic approach, this chapter discusses how a significant paradigm shift during the late eighteenth century and during and after the nineteenth century led to the development of *in vitro* fertilisation (IVF technology hereafter). This 'scientific revolution' in biology is backed by the fundamental philosophical and teleological principles of most ancient Greek and modern European philosophers. The innovation and development of IVF technology can be traced back to the contestation in its parental discipline of developmental biology.

Historically, the developmental biology discipline has experienced contestation about the genesis of life. This contested space, however, is embedded with gendered biases and social stigmas mainly derived from the dichotomy of religion and science. This debate in developmental biology is known as preformationism versus epigenesis. In simpler terms, the former believes that embryos or individuals already exist either in the mother's egg or the father's sperm in a miniature form and that they start growing after stimulation. On the other hand, the epigenesis approach denotes that an embryo is developed from an undifferentiated mass that grows eventually, to which new parts get added during its development to become an individual (Van Speybroeck & Van De Vijver, 2002, p.7, 14, & 20). However, IVF technology may look closer to epigenesis as its former technology succeeded in creating human embryos outside the human womb in an external environment from the stimulation of egg and sperm. It is argued in this chapter that preformationism continued playing a crucial role at many

stages of the development of an embryo to term a child through IVF technology. This chapter, therefore, discusses those nuanced contentions in the discourse of logic and origin life from its journey of philosophical and reasonable understanding to the creation of life through IVF technology. This chapter discusses the social and cultural contexts under which medical and IVF technologies were developed and used and how the development of this technology shapes our understanding of the body, mind, and human reproduction. In other words, this chapter discusses the social shaping of the formation of life in general and humans in particular, the development of science and epistemology on reproduction, and finally, the development of IVF technology.

Logic and origin of IVF technology in a macroscopic era

The logic and origin of IVF technology can be traced back to the debate on the origin and development of biology, started from the philosophical ideas of Pythagoras (ca. 570 to ca. 490 BCE), an ancient Greek philosopher and the founder of Pythagoreanism. The latter is a philosophical school that adopted the 'doctrine of metempsychosis.' In other words, Pythagoreans believed in the transmigration of the Soul after death from one life to another with a new body³. Based on Pythagoras' doctrine, Aristotle explained two distinct theories of generation, i.e., preformationism and epigenesis. Preformationism implies that an 'organism or miniature individual already exists either in the female egg or in the male seed that starts growing when stimulated.' On the other side, epigenesis theory implies that an 'embryo developed from an undifferentiated mass to which new parts are added during the development of the same to become an individual.' Aristotle believed in epigenesis theory. In the book *Generatione Animalium*, Aristotle describes the cause of the human organism. According to Aristotle, four reasons, i.e., material, final, formal, and efficient, functioned in organising and producing the development of individual organisms.

Both Pythagoras and Aristotle were 'spermists' who provided a male-centric view on the origin and development of generation. In this 'spermist' position, Aristotle believed that male sperm carries an individual's form and Soul. Although the use of the term epigenesis is unclear in the writings of Aristotle, his writings, mainly the book *Generation Animalium*, give a foundation to understand the history of epigenesis (Van Speybroeck & Van De Vijver, 2002). The primary concern for Aristotle was to study how teleological activity arises from the animal's internal

³ For more details on Pythagoreanism, see Huffman, C., & Zalta, E. N. (2018). Pythagoras' The Stanford Encyclopedia of Philosophy.

organic form. Aristotle studied the formal nature intrinsic to adult organisms and the dynamics behind development and embryology to understand teleological activity. His natural philosophy examines the dynamic process between organised parts to explain the nature of life (Cosans et al., 1998). Organism, in this sense, is not a machine but entities that originate and live by their own internally directed process. Unlike preformationism, Aristotle's scientific experiment involves anatomy, which allows cutting off the organism and studying the parts. Aristotle believed that different features are integrated into an organised whole, which he calls *the Soul*. On the principle of the Soul, "the organism maintains its organic form by holding its end within itself (ibid, p. 328)." Aristotle studies the formal nature and the growth of adult organisms; the dynamism behind embryo development as a teleological activity arises from an animal's internal organic form. In other words, Aristotle's central project was to study the coming into being or ontogenesis of the embryo and adult organisms and its internal dynamic process. The Aristotelian teleological account of studying an organism's telos or species-specific goal is essential to understanding organisational development (Van Speybroeck & Van De Vijver, 2002).

Aristotle took the chicken as a 'model organism.' He systematically opened one developing egg each day for twenty-eight days to observe the details of the organism process with his unaided eye (mentioned in Van Speybroeck & Van De Vijver, 2002). This chicken-egg experiment of Aristotle convinces us that once semen enters the female body, the *vital heat*⁴ of Male semen passes on to the material inside the female egg, and then the semen disappears. Though the role of semen is essential to generating life, Aristotle believed that the "vital heat" generated from male semen holds generative power and that "the semen, if cold, is not generative" (Aristotle, 1910, Book I, Part 7, mentioned in Ackert, 2016). Blood forms from the mixture of vital heat or Soul with the material in the female body, and the organism starts with the heart's development from the blood. In this context of organism development, Aristotle stood against pangenesis, later called preformationism. Pangenesis theory is most associated with the name of the Greek Physician Hippocrates⁵. According to the pangenesis theory, all parts of an adult body provide some specific material to the seed for the organism's development. By criticising pangenesis, Aristotle stated that there is no simultaneous creation of all body parts or no pre-

⁴ According to Aristotle, 'vital heat' contains the '*soul, or eidos*', which is necessary to start life from a non-living being. For more details, see Ackert Jr, L. T. (2016). *Origins of Life, History of* in Kliman, Richard M. *Encyclopedia of evolutionary biology*. (pp. 181-185) Academic Press.

⁵ See Tsiompanou, E., & Marketos, S. G. (2013) for more details. Hippocrates: timeless still. *The Journal of the Royal Society of Medicine*, 106(7), 288-292.

existence of the embryo. Aristotle's teleological view says that the purpose of nature is to determine the development process of the being rather than the other way around. Like Plato, Aristotle believed that 'form is not independent of matter, but embodied in the matter' (mentioned in Van Speybroeck & Van De Vijver, 2002).

Galen from Pergamos (129-200 A.D.) was known as an outstanding Greek physician after the Greek physician and philosopher Hippocrates. Galen observed the aborted fetus and concluded that parts of the fetus were predeveloped (mentioned in Van Speybroeck & Van De Vijver, 2002). From this observation, Galen may look like a Preformationist but is mainly influenced by Aristotle's work. In the book *On the Natural Faculties*, Galen disagreed with the atomist position. The latter part implies that the wholeness of the body accidentally comes together from atomic elements; qualitative changes as an illusion of our senses; flesh, bone, and bone attract flesh, bone, and blood in food, respectively.

On the other hand, Galen argues that the bread gets digested, becomes blood, and nourishes other organs to grow. In Galen's view, nature performs as a better or more intelligent craftsman. Galen observed that blood from the mother is converted to functional tissues and organs by semen. Furthermore, nature does not provide the original character of any mother. Organisms develop from genesis upon genesis, i.e., epigenesis. The later analysis of Galen depicts that he advocated epigenesis rather than preformationism.

From the sixteenth century, power was discerned to personal investigations despite lacking appropriate instruments or investigation methods. Unlike Aristotle, in the seventeenth century, William Harvey (1578-1657) disagreed with the doctrines that believed sperm is the sole cause of embryological development. Scientific understanding of life and life formation grew mainly from the seventeenth century to the start of the scientific revolution. In Harvey's account, the female egg is given equal importance in finding the reason for embryological development. Harvey discovers the blood articulation in animals and the role of the heart in this process. In his book *Disputations Touching The Generation of Animals*, Harvey points out the development process, which proceeds from homogeneous material that changes over time, forming one organ after the other. To discover how and by what means this homogeneous matter gets organised into fully developed organisms, Harvey focuses on the role of the male semen as the primary principle of movement in embryonic development. To understand the fertilisation process, Harvey took up an experiment and dissected many recently fertilised deer to observe visible traces of the semen. Unlike Aristotelian tradition that assumed the existence

of a uterus filled with menstrual blood and semen, Harvey did not find anything of such kind in the uterus of the deer and the developing egg, nor did he see any change in the female organs. Harvey concluded that there was no prepared material in the egg or any preformation of the organism. Though he favoured the existence of a divine or vital agent, he rejected the bifurcation of material based on a function that says one part preexists. The other parts get nourished from the former. According to Harvey, the fetus is nourished from the same material it is made up of. The actual generation, according to Harvey, is the gradual epigenesis. With Harvey, the macroscopic era came to an end.

Spermism in rise: Beginning of a new paradigm under the guise of microscopic observation

A new scientific paradigm emerged after the end of macroscopic embryology with Harvey. In this new paradigm, the study of organisms and embryology developed in a more 'scientific' or 'objective' manner. At the beginning of the seventeenth and eighteenth centuries, science insisted on repeating one's observation under different circumstances to reduce the impact of phenomenological and anthropomorphic experiences. In other words, the subjective experience of human beings and the study of non-human entities, such as mass or organisms, by attributing human-like characteristics, lost their ground with advancing more scientific and objective research approaches. The new era of philosophy and science gave more weightage to empirical observation. The introduction of the microscope opened the infinite scope for the pursuit of truth. During 1640 and 1690, independent research committees were found to lead to a micro-observation explosion. Italian biologists and physician Marcello Malpighi (1628-1712), the Dutch microbiologist Antoni van Leeuwenhoek (1632-1723), and Jab Swammerdam (1641-1712) rejected the existence of a vitalistic element in the formation of embryo and life. According to these microscopist biologists, the thought of vitalistic elements in embryo formation leads to the development of atheism or occultism, which is non-scientific. They found a balance between intelligible material mechanisms and theistic natural order. Although microscopic research began in the early seventeenth century, it is used to study the visible structure of physiological processes started only from 1660 onwards.

Epigenesis was under attack for its dependency on Aristotelian authority that emphasised 'unmechanised vital faculties,' which account for the development of the embryonic organisation (Van Speybroeck & Van De Vijver, 2002). Though there seem to be differences between epigenesis and preformationism in the metaphysical ground, the distinction disappears

when the discourse is pushed back to the start of the embryo's life. Therefore, the debate between epigenesis and preformationism can exist in a continuum (Ibid. p. 14). In the metaphysical ground, preformationism's explanation distanced itself from using vital factors in the development of organisms. In contrast, the epigenesis approach engaged more with the former approach.

Nevertheless, preformationism defends that the whole organism preexists potentially in a small form or a miniature form inside the egg in a preformed manner that needs further sequential perfection. Preformationism's account of the existence of the miniature form of organism paved the way for the mechanical study of the same through a microscope. Marcello Malpighi (1628-1694), the defender of ovism and advocate of seventeenth-century preformationism, found embryo-like structures in the pre-embryo stage. Malpighi microscopically re-examined Harvey's observations and found embryonic structures in eggs earlier in embryo development in the fertilisation process. Malpighi's comparative account strengthened the preformationism argument. Jan Swammerdam (1637-1680) did microscopic observation on silkworms and rejected Harvey's metamorphosis, which believes that one organised matter immediately changes into a new form of organised matter. Harvey concludes that an organised tissue needs three stages of development that do not occur simultaneously. The French Cartesian priest Nicolas Malebranche (1638-1715) extended the preformationist debate with the encapsulation approach. Malebranche concludes that one generation contains the next generation even though no organic relation exists between the distinct generations.

As seen in this discussion, most of the scientists or physicians of that time were spermists and believed that the development of organisms was a divine task. There were two reasons which proclaimed the dominance of spermism over ovism. First, it was inconceivable for those physicians to believe that the 'divine task of carrying all future life should be attributed to the female, which was considered a minor being' (ibid. p. 16). The second reason was the challenge of investigating the ovary through a microscope due to its complex structure. Antoni Van Leeuwenhoek did a microscopic investigation of human seed in a sick man in 1677 and observed several animalcule or wormlike creatures. From this study, Leeuwenhoek assumed that animalcule exists in a body as 'parasites or ill-making seed animals.' In the later study, Leeuwenhoek killed a mated female dog by running an 'awl'⁶ into her spinal cord. He observed

⁶ Awl is a tool typically made of leather or wood used to make holes in the body, especially in the spinal medulla, to kill a dog quickly and humanely so that the killed dog could be used to dissect her reproductive system for scientific study.

that a spermatic animalcule exists in the fallopian tubes of the dog. He speculated that the animalcule connects itself to the uterus through a vein from which it gains nourishment. Though Leeuwenhoek started the microscopic study of female eggs in his experiment, his speculation of the role of the egg as only the source of nourishment to animalcule (primarily existing in the semen) pushed his analysis closer to the Aristotelian teleology. Further, the spermist Nicolaas Hartsoeker (1656-1725) gave some or little agency to the female by claiming that spermatic unites with the egg during fertilisation, and the animalcule inside the sperm becomes one with the female egg through blood circulation. Hartsoeker (1695) drew a human-like tiny person or a "*petit enfant*" (in French) curled up inside a sperm cell in his book *Essai de dioptrique*.

A shift towards ovism and regeneration of organisms

In the eighteenth century, spermism failed its ground to reason many 'physico-theological'⁷ Questions like the reason for the loss of 'souls' during the birth procedure and why "monsters were born despite preformation" (quoted from Müller-Sievers, Self-Generation (mentioned in (Van Speybroeck, L. et al. 2002, p. 19). Even during the seventeenth and eighteen-century humans born with bodily malformations like congenital anomalies were perceived as omens or punishments of a vital origin and, therefore, monsters (Beckwith et al., 2012, p. 1). Spermists failed to provide a scientific explanation for the non-fixity or abnormal birth. On the other hand, Ovism gained strength by investigating the discovery of eggs in female rabbits, a study conducted by the Dutch physician Reinier de Graaf (1641-1673). Besides, ovism was influenced by the work of the Swiss physicians von Haller, Bonnet, and Lazzaro Spallanzani (1729-1799). Von Haller moved from spermism and started adopting the principle of epigenesis in his experiment on chicken eggs. He observed the development of embryonic heart formation in chickens. Using his investigation on chicken eggs, Haller argues that epigenesis is the gradual appearance of preformed invisible structures through solidification. He figured this unknown law was caused by topological change and rejected the idea of a mysterious force. Haller believed that this solidified structure reflects the essential parts of the fetus and already existed in the unfertilised egg. Though Haller adopted the epigenesis process of studying generation, he distanced himself from epigenesis and redefined his ovism with the notion of encapsulation, as he said,

⁷ Physico-theological perspective attempts to prove the existence of God in the making of life.

"If it follows that the ovary of an ancestress will contain not only her daughter but also her granddaughter, her great-granddaughter, and her great-great-granddaughter, and if it is once proved that an ovary can contain many generations, there is no absurdity in saying that it contains them all" (cited in Van Speybroeck & Van De Vijver, 2002, p. 20).

Haller continued to defend the preformationism doctrine. During a similar time, the Italian catholic priest Lazzaro Spallanzani (1729-1799) was said to have invented artificial insemination. Spallanzani is the founding father of modern *in vitro fertilisation* (IVF), who did fertilisation by mixing frog eggs and frog sperm, where organisms occurred naturally outside the body (Greely et al., 2016). Though Spallanzani observed that frog spawn or egg and sperm have similar qualities before and after fertilisation, he rejected epigenesis. He did not pursue his research further nor incorporated his colleague Abbe Felice Fontana's (1730-1805) suggestion. Fontana pointed out that the absence of organisation before fertilisation provides evidence of the absence of preformation and justifies epigenesis. Spallanzani shifted his attention to the Aristotelian account of the spontaneous regeneration of organisms while upholding the preformationism position. Spallanzani's statement was developed as a challenge to the epigenesis thesis focused on the regeneration of organisms out of nonliving matter. A religious debate erupted against the strict mechanist account of epigenesis as the spontaneous regeneration of organisms questioned the role of God (Mentioned in Roe, 2003). John Turberville Needham (1713-1781), Pierre-Louis Moreau de Maupertuis (1698-1759), and Comte de Buffon countered the strict mechanist and extremes of pre-existence (Roe, 2003).

Buffon attempted to combine preformationism and epigenesis in a mechanical model, bringing nourishment as the means of regeneration of the organism. According to Buffon, a preexisting organic matter grows from the nutrition it receives from external sources like food it eats. The organic body is sustained during regeneration by the nutrition it receives from similar material particles. The organic particles obtained through food are transferred to the embryo's development through 'internal mold' or internal laws. Furthermore, seminal fluids are generated from the surplus particles from all the organism's parts. The molecules are seminal fluids that come from both the parents' aggregates via magnetic forces like (gravity and magnetism) and with a preexisting molecular (consisting of different molecules or atoms). Buffon does not explain the details of the internal mold. To justify the work of internal mold, Buffon considers the role of some 'penetrating forces' that govern gravity, chemical affinity, and magnetic

attraction (Ibid, 2003, p. 17). This penetrating force ensures the assemblage of organic particles and internal mold to form an embryo.

In the meantime, De Maupertuis gave a nonmechanical account of epigenesis that challenged preformationism. This new epigenesis account was based on the 'attractive forces' principle. Maupertuis postulates that male and female seminal fluid carries particles derived from both bodies; when two seminal fluids from the opposite sex are mixed, the embryo starts to grow from the particles released from the fluids; in Maupertuis's view, particles predetermined to form the heart, head, entrails, arms, and legs. If these particles had a special attraction for those to be their immediate neighbours in the animal body, that would lead to the formation of the fetus (1745, 1966 translated p. 556, mentioned in Roe, S. A. 2003). The French mathematician, naturalist, and geometer Rene-Antoine Ferchault de Reamur (1683-1757) challenged Maupertuis's nonmechanical epigenesis account on the ground that the former disbelieved the attraction is not sufficient for the development of the embryo. According to Reamur, attraction can do no more than only cluster particles. Reamur hypothesised that the particles generated from seminal fluids remembered their previous location and were instinctive to regroup or regenerate (mentioned in Van Speybroeck & Van De Vijver, 2002, p. 21). With a similar view to Reamur's contemporaries, John Tuberville-Needham (1713-1781), the English biologist and Catholic priest, attributed 'the attraction between the material parts to vitalistic forces and proposed for a spontaneous generation.' Needham was the first Roman Catholic clergyman to become a member of the Royal Society. Spallanzani falsified many of Needham's experiments and nullified the 'spontaneous generation of microorganisms.' Spallanzani calls spermatoc fluids 'parasites' that contribute nothing to generation. For Spallanzani, spermatoc fluids are essential only for embryonic growth.

In the meantime, two Swiss naturalists, Abraham Trembley and Charles Bonnet, rejected the vitalistic presumptions of Aristotelian epigenesis and offered a materialistic preformationist perspective. Abraham Trembley (1710-1784) experimented on freshwater hydra and discovered the former's extreme epimorphic regeneration power. This experiment disclosed a new form of research. Trembley's experiment cleared out the fundamental issues related to the development and regeneration caused by damage and clarified the differences in animal and plant regeneration. Naturalist and microscopist Hartsoeker's preformationist account implies that "the intelligence which can reproduce the lost claw of a crayfish can reproduce the entire animal" (Harsoeker, mentioned in Van Speybroeck & Van De Vijver, 2002, p., 21). Preformationism was challenged by regeneration to incorporate the resulting experiment

outcome into its theory. In other words, preformationism failed to include the results from multiple experiments conducted during the time to substantiate its data to its approach. As a result, preformationism gathered metaphysical arguments to develop its theory. This theory proved nothing except mere speculation on the development of organisms. The preformationist proposed regeneration theory implies that the crustacean limb grows from the minuscule preformed limb from a tiny egg inside the body's amputated part. Reamur challenged this regeneration theory of preformationists. While Reamur discovered that crustacean limbs have the regeneration power in their whole limb, he rejected the preformationist hypothesis suggesting that the entire limb is filled with infinite preformed eggs. Though Reamur was not an epigenesist and challenged the regeneration theory of eighteenth-century preformationists, he saw 'regeneration as proof of natural teleological design or the role of divine intervention in the origin of the organism.'

Preformationists' second problem was the 'soul position during generation' (ibid. P., 22). Charles de Bonnet started experimenting with the regeneration of Hydras as per the instruction of his advisor, Spallanzani. Bonnet generated a theory claiming the Hydra soul is based on some organising principles located in the head of the Hydra, and this Soul is not spiritual. Regeneration of Hydra's cut-off head thus was not explained by Bonnet as resulting from Hydra's slipping Soul. Bonnet instead argues that Hydra's amputated head has a separate soul, and each head is grown from several embryos, each of which has a soul. Though Bonnet's regeneration theory expanded the development of germs, the germs he discussed were difficult to prove as they were invisible. As a result, Bonnet based his argument on a philosophical and aesthetic basis. It was also true that Bonnet's primary objective was not to develop a scientific account of regeneration or gene; he instead created an organic preformation profile of the whole to oppose mechanist epigenesis.

Growth of German ideal: A move from transcendentalism to empiricism

While the seventeenth century marked the rise of preformationism, which continued to dominate even in the eighteenth century, epigenesis started to grow, particularly from the work of the German physician Caspar Friedrich Wolff (1733-1794). The middle of the eighteenth century experienced the conflict between Wolff's epigenesis account and Haller's preformationism doctrine. Though Wolff initially took a vitalist position, he later shifted from a vitalist to a more rational materialist position. In his Ph.D. dissertation, *Theoria Generationis*, Wolff developed a general theory on the principles of generation to reason the development

and organisation of plants and animals. While overcoming the teleological and regenerative perspective of preformationism, Wolff gives a mechanical and deterministic account of generation development. At the same time, Wolff denies a purely mechanical explanation of life because the machine does not generate the 'power' of life that Wolff wanted to study. At this point, the agency of making life is shifted from machines or tools to the power of regeneration of life on its own. Spinoza's natural philosophy heavily influenced Wolff's account of epigenesis. Spinoza's natural philosophy sees everything, including humans, as part of nature. Though Descartes inspired Spinoza, he later rejected the 'body-mind dualism' and argued that body and mind or Soul are not separate; they are two aspects of the same substance.⁸ Wolff believed that in the generation process, 'in organised matter' is organised into 'organic matter.' Two things are important for Wolff, i.e., the secretion-solidification model and the essential force required for embryological growth, both in plants and animals.

Wolff rejected preformationism and argues that the embryo is created gradually from the secretion and solidification of fluids under the supervision of the essential forces. In the chicken-egg experiment, Wolff observes an increasing embryo from the moment of incubation, following a visible heart. Similarly, Wolff observed a folded leaf in a miniature form inside the older leaves in plants. Wolff rejected the existence of the miniature form as a preformation; he believes that it is rather an example of epigenetic development from the point of view of vegetation. Wolff talks about the importance of nourishment from the egg to the embryo. A force exists for the nourishment to pass from egg to embryo, which Wolff calls 'the essential force.' Due to his emphasis on the role of essential force, which, according to Wolff, is responsible for embryonic development, Wolff is often considered a vitalist. Wolff's mechanical account of epigenesis account was heavily criticised by Albrecht von Haller (1708-1777), the Swiss naturalist.

The debate on the formation of blood vessels in vasculosa was influential in the controversies of Haller and Wolff within the contestation of embryological development. Vasculosa is a network of blood vessels formed during embryonic development. Various stages of development of vasculosa were fully described by Malpighi later, as earlier they were brought into the epigenesis debate by Aristotle and Harvey. However, Malpighi's explanation did not

⁸ For details of Spinoza's natural philosophy, see De Spinoza, B. (1994). *A Spinoza reader: The ethics and other works*. Princeton University Press.

clearly distinguish between 'vitelline' and the 'allantoic circulation.'⁹ Apart from this, Malpighi did not explain the analogy of the 'avian umbilical vessels.'¹⁰ Nevertheless, Wolff and Haller were the ones who brought out the importance of vasculosa or blood vessels, and the work of both advanced over Malpighi's observation. Malpighi claimed that the vasculosa is the area of increasing visibility of the preformed embryo, which is responsible for the appearance of blood vessels. In his explanation, Malpighi failed to provide support to keep his preformationist argument intact. Haller, Wolff's staunch antagonist, was the first to make a preformationist account of the gradual appearance of the vitelline vessels. Contrary to Haller, Wolff proposed that the proponent of an epigenetic account of the development of vasculosa is the central principle based on which the preformation and epigenesis debate started to grow in the eighteenth century.

For Haller, the vasculosa area became essential for developing preformed embryonic parts. Wolff published the *Theoria generationis* a year later, the development of the vasculosa area, which was used as the principle of Wolff's epigenesis account. Wolff maintains that a series of "rings" formed in the 'vasculosa area' (the area umbilical) in the early stages of embryo development. According to Wolff, these rings are formed by the movement of fluids from the yolk to the embryo. Wolff says these rings are formed from the nonnutritive deposits, the non-organised matter of the embryos, or organic matter. The yolk substance begins to dissolve during the early moments of development under the warmth of incubation, and it moves toward the embryo as it is guided by the essential force (mentioned in Roe, 2003). For Wolff, these movements of dissolved yolk substance into the embryo provide evidence of vital essentials. According to Wolff, the heart cannot be observed in the early hour of incubation and, therefore, could not be responsible for the 'observed movement of fluids' and embryonic development. The heart develops in the gradual process of the organism.

Wolff sent a copy of his dissertation to Haller for judgment. As a response to Wolff, Haller published 'an anonymous review of Wolff's thesis, *Theoria Generationis* in the *Gottingische Anzeigen von Gelehrten Sachen*, summarising Wolff's embryological development. Haller argues that Wolff's epigenesis model rests upon an unwarranted assumption that one cannot

⁹ Vitelline and allantoic circulation are two important circulatory systems in the developing embryo of birds and reptiles. Both vitelline and allantoic circulation are connected via the umbilical cord, which contains both the vitelline duct and the allantois. Their connection allows for the exchange of nutrients and the removal of waste products between the two circulatory systems, which ensures the proper development of the embryos.

¹⁰ Avian umbilical vessels are the blood vessels in the umbilical cord of birds. The umbilical cord connects the growing embryo to the yolk sac, that provides the embryo with nutrients and oxygen during its development.

conclude an observation if one does not observe a structure. In the debate, Bonnet extended his support to Haller's preformationist account. Wolff also criticised Bonnet for uncritically supporting a preformationist account. In response to Haller's critiques, Wolff argues that his account is not based on the principle that says, 'what one does not see, is not there.' Instead, Wolff's epigenesis account is based on the principle, 'One can observe the gradual formation of vessels; one does not simply assume that they do not exist before they are visible.'

For Von Haller, the heart that exists in its complete form is responsible for developing the preexisting embryo. On the other hand, Wolff argues that no heart exists during the early stages of development, and the heart develops gradually while taking nourishment from the essential forces. Wolff observes that an embryo begins to develop before a heart can be seen to exist. Therefore, Wolff emphasises the role of an essential force for fluid's early movement. Haller took a preformationist position during his observation on the development of the heart to disprove Wolff's epigenesis experiment. Haller was inspired by Malpighi earlier and started experimenting on chicken eggs to understand Malpighi's assumption, i.e., to study how pulmonary circuits were developed in the chicken embryo. Haller derived his conclusion on developing the embryo's heart from new observations of chicken eggs to defend his preformationist position against Wolff's epigenesis account, mainly after Wolff deposited his PhD dissertation to Haller for a judgment. Haller argues that 'if the heart is not visible earlier, it is because of its smallness, transparency, whiteness, and resemblance to a mucous cellular substance concealed it.'

With time, Wolff's epigenesis account found more stand in modern-day developmental biology, where many scientists experimented with more rationalist positions in each stage of embryonic development. Haller and Wolff's conflict over epigenesis and preformationism implies that the scientific discovery of the development of the intestine or embryo in the observation of Haller and Wolff was never for medical reasons. Instead, Von Haller, heavily influenced by empiricism and Newtonianism, was critical of dominant Cartesian metaphysics and German rationalism. Haller's natural philosophy primarily intended to unfold God's creation and prove it as a universal mechanical law, which, according to Haller, could be confirmed by repeated experiments, though not in a rationalist sense. On the other hand, Wolff's natural philosophy was a departure from the rationalist view prevailing at that time.

Wolff's theory was influenced by his philosophical outlook, shaped by the 'rationalist tradition of the Enlightenment' (Roe, 1979). The debate between Wolff and Haller continued during the

middle of the eighteenth century and took significant attention and textual format. Wolff moved from *vis essentialis* to *natural wesentliche Kraft*. In the *natural wesentliche Kraft*, Wolff emphasised the physicalistic causal principle that, according to him, is responsible for embryonic development while excluding vitalism. To this shift of Wolff, Roe argues that by denying total reductionism, yet unwilling to ascribe to vitalism either, Wolff sought to create an explanation for mechanical life processes yet unique to living creatures. (Roe, 2003, p., 110). Wolff took this new position in his epigenesis account after the publication of his *Von der eigenthumlichen und wesentliche Kraft der vegetabilischen sowohl als auch der animalischen Substanz* in 1789 and after the vanishment of Haller's academic influence. The later development of Wolff's epigenesis ideas brought them to the nineteenth-century debate on teleological epigenesis in an idealistic context.

Wolff's teleological epigenesis was supported by the German philosopher Immanuel Kant (1724-1804). In his book *Kritik der Urteilkraft* (translated as Critique of Judgement) of 1790, Kant agrees that *Naturerkenntnis*, i.e., knowledge of nature needs to be described mechanically to show all parts as adequate causes of the development of a whole organism. Kant's epigenesis philosophy was heavily influenced by Friedrich Blumenbach's *bildungstieb* or natural force of nature. Towards the end of the eighteenth century, theoretical weights had shifted their position against evolution with the publication of a book *Über den Bildungstieb und das Zeugungsgeschäfte* (On the Formative Force and the Operations of Reproduction', 1781) by the Gottingen physician and physiologist Johann Friedrich Blumenbach (1752-1840). This book introduced the concept of the 'nature of force' called 'life.' Blumenbach made his observation by cutting away sections of Hydra's body to investigate the regeneration of parts. From a series of observations on Hydras, Blumenbach concluded that a *Bildungstieb* or natural force exists to regenerate the damaged bodies of Hydra. Blumenbach also believed that *Bildungstieb* endows the capacity to form a new organism by developing an embryonic life structure, unlike Needham's *vis plastica* (attraction between material force to vital force) or Wolff's *vis essentialis* (essential force) according to Blumenbach, *Bildungstrieb* is responsible for reproduction, nourishment, and restoration of the parts of an organism (mentioned in Richards, R. J. 2000, p. 18). *Bildungstrieb* is architectonic and directs the the operations of physiological processes of the organism and formation of anatomical structures. The primary objective of this force is to meet its end, i.e., the formation of organisms. For Blumenbach, *Bildungstrieb* carries the formless, homogeneous mixture of female and male semen with its essential character, forms, and organisation and sets various parts of it so articulated into

mutually harmonious operation. This results in a teleological reason for organism formation through the assistance of *bildungstrieb*.

Kant calls *bildungstrieb* as teleological epigenesis. For Kant, teleological epigenesis was responsible for building an epistemological relationship between mechanical and physical ways of explaining an organised whole. For Blumenbach, *bildungstrieb* is not an epistemological teleological mechanism but a distinct ontological force that helps organise matter for the organism to form. Although *bildungstrieb* is described as a force that drives life into form, it failed to explain its primary cause. Moreover, only the secondary casual feature of this force can be investigated. Blumenbach's *bildungstrieb* primarily borrowed ideas from the Newtonian role of general laws that support the formation of visible effect from the invisible or unexplainable force.

While incorporating teleological epigenesis ideas from Blumenbach's *bildungstrieb*, Kant postulated three positions from his review of developmental biology. Firstly, Kant rejects *occasionalism*, which says that in copulation, male and female matter immediately takes up its whole organic structure, presupposing a supernatural creational act during every single copulation. Secondly, Kant remarks on two theories of 'preformed harmony.' Preformed harmony is ascribed to the initial germ products responsible for making another organic being like itself. According to Kant, this denies nature its power to take its form. Preformed harmony would mean that all the formative power is established at the beginning of time. Kant rejected it on the concrete biological ground that all embryos are formed (in large numbers) and remain intact during the lapse of time. According to Kant, this position is incapable of describing dual parenthood, or this would allow both parents to possess formative power. However, it was not easy to prove formative power.

Kant emphasises the second theory of preformed harmony, i.e., epigenesis. The latter approach says the embryo is the product, according to Kant, 'generic preformation,' i.e., the embryological process is 'species-specific' or associated only with one species, not as encapsulation. Roe calls 'teleological epigenesis' this generic preformation position of Kant. According to Roe, the latter posits a relationship between 'self-maintaining purposiveness' and a mechanistic explanation of the gradual development of the embryo (Roe, 2003, p. 151). *Bildungstrieb* is often criticised as a 'teleo-mechanistic principle,' which Kant adopted to represent a mechanical reason for organism formation as they are teleological (Lenoir, 1989) P., 22-24. Both Kant and Blumenbach support 'the same program,' i.e., of 'teleological

mechanism' (ibid P., 22-24). Teleo-mechanism, therefore, became a methodological core that most late eighteenth-century physiologists and scientists used to explain the formation and development of organisms in the latterly-called discipline' of developmental biology.

German naturalists, physiologists, and embryologists contributed to the embryology study from the 18th century onwards. Lorenz Oken, Karl Friedrich von Keilmeyer, and the embryologist Karl Ernst von Baer (1792-1876), among others, were the most important scholars to have contributed to the study of embryology in developmental biology. They primarily focused on the study of moderate epigenesis. They started to use the term *Entwicklung* (the German term translated to English as development) like the present-day use of the word. Their primary focus was to unfold the inherent organic process rather than unfolding preexisting organic forms. Charles Darwin (1809-1882) emphasised the connection between 'development to evolution and from evolution to development.' In the book *The Origin of Species* (1859), Darwin focused on the study of embryos of many species. Darwin observes that the early stages of embryonic development come from the ancestors, and the later stages result from adaptations to external environmental conditions. In other words, for Darwin, while the early stages of embryonic development remain similar for most species, in the later stage, embryos descended from the same ancestor through natural selection. It may look like Darwin built his theory by borrowing ideas from his contemporary von Baer's laws of development.

On the other hand, Baer never accepted Darwin's concept of evolution through natural selection. Baer proposed that creation has a different origin and divergence. According to Baer, creation occurs in the developmental process; it does not exist in the fundamental pattern. The German naturalist Ernst Haeckel shared Darwin's approach. Haeckel observed close similarities in the early developmental stages of embryos of different organisms. He proposed that embryos of varying organisms resemble each other because they share a common ancestor. Haeckel's proposal was very controversial at that time. What is important to discuss here is how the agency of embryo formation in the Darwinian evolution approach is assigned to a common ancestor and the natural environment in its later stages of development.

Since the study of the embryonic organisation was prioritised, the prime focus during the eighteenth century shifted from studying ontogenesis to understanding how to describe the organisations in detail as accurately as possible and how to interpret the term 'preform' with the fact of developmental biology. In other words, a shift started from a rationalist understanding of life to a more empirical one. Formerly discussed teleological epigenesis continued to play

an essential role in the debate on the contribution of organisational principles in developing organismic form. This natural philosophy was influenced by 'German idealism' such as Schelling's 'objective' idealism, Kant's transcendental idealism, Fichte's 'subjective idealism,' and Hegel's 'absolute idealism.'¹¹ German idealism was a reaction to materialism, which supported rational ideas as the basis of knowledge formation. Teleological epigenesis continued to play its role as German idealism influenced natural philosophy. Preformationists experienced strong opposition from the epigenesists.

In contrast, preformationists focused more on transmutation (the growth of an embryo through its internal logic or internal force and from its environmental stimuli) that led to the appearance of new species. Furthermore, epigenesist embryologists associated them with phylogeny (a way of understanding the genetic changes of species) and with the idea of recapitulation (repetition of an evolution process). This connection with phylogeny and recapitulation made epigenesis closer to evolutionist thought. Evolutionist thought became more acceptable. Subsequently, in the nineteenth century, embryology was understood as the 'study of the form' strictly associated with factual knowledge.

A move from speculation to scientific experiments: Agency shift from vital entities to scientific inquiry

The rise of empirical methods in natural sciences and historical-critical methods in the human sciences (Marx and Engel), along with the growth of Neo-Kantianism and positivism, led to the eclipse of German idealism towards the end of the nineteenth century. During this period, scientists started doing empirical observations and experiments on the embryo. The primary objective of these scientific inquiries was to understand the embryo as a material and biological object with its internal logic and process and how it is formed in response to its environment (Maienschein, J. 2014. P., 3). These scientists ultimately rejected vitalism and its contribution to embryo formulation. Mechanic and reductionistic explanations replaced vitalistic and teleological explanations. These scientific studies started gaining strength from the development of organic chemistry, experimental physiology, and molecular cell theory. Towards the end of the nineteenth century, descriptive analysis was replaced with causal and experimental embryology, mainly in the works of Swiss anatomist and the co-founder and

¹¹ For details of German idealism, see Ameriks, K. (2000). Interpreting German Idealism. *The Cambridge Companion to German Idealism*. Cambridge University Press.

president of the German Anatomical Society, Wilhelm His (1831-1904), German zoologist and embryologist Wilhelm Roux (1850-1924), and the German biologist Hans Driesch (1867-1941).

Meanwhile, America began to start its embryological research programs with zoologist and geneticist Edward Beecher Wilson (1856-1939), Embryologist Thomas Hunt Morgan (1866-1945), biologist and zoologist Edwin Grant Conklin (1863-1952), biologist and anatomist Ross Granville Harrison (1870-1959), etc. German biologists continued to establish that development results from some internal mechanical laws of form. Their primary focus was to study the unknown law inside the zygote, which, according to them, is responsible for the formation of an organism and not how it is not preformed. Instead of studying how the organism takes form, they focused on knowing the 'what' that led to its development. This means researchers started seeking interest to know if any external variables or factors like temperature, gravitational direction, light, etc., affect embryonic development. At the beginning of the nineteenth century, scientists observed and experimented on animal bodies, particularly frogs. Later, Wilhelm His was among the first to start human embryo collection and started observing human embryos mechanically.

Wilhelm His vehemently rejected Haeckel's organism development link with the evolution theory. He suggested a material preformation rather than a morphological preformation to the stages of human embryonic development (Maienschein, 2014, p. 49). He brought together the study of cells and the study of embryos. His hypothesis was to study '*the zygote was not to be regarded as a totally unorganised bit of protoplasm but of having some substances- not force or immaterial organising principle- that were the sine qua non for differentiation*' (quoted in Van Speybroeck & Van De Vijver, 2002, p., 508). In other words, he proposed that the zygote was not just an unorganised protoplasm or some force but that it had some substances. His rejected the previously held vitalism contribution to embryonic development. He suggested that a chick embryo fate map can be prepared by careful observation. His integrated the study of embryos and the study of cells. Although he hypothesised about embryo formation, he did not prove it. His's hypothesis continued to be helpful for Wilhelm Roux and others to experiment on egg organisation.

Wilhelm Roux brought revolutionary experimental embryology to its complete form (Maienschein, 2014., p., 67). Roux attempted to understand the causes of development using mechanical methods similar to those used in physics and chemistry. He emphasised the

material explanation of formative force and rejected the speculative vitalistic force. It is from Roux's investigation agency shifted from mere speculative ideas of vital entities to the material form of force responsible for life formation. Roux's approach advocated a form of preformation or predeterminism. Still, unlike the previous speculative vitalist ideas, it suggested the 'nucleus'¹² and the hereditary units carry the determinants for organism development. Roux attempted to investigate the degree of development of fertilised eggs and how this development is influenced by environmental factors or the internal process of 'cleavage.' Roux studied frogs and observed that the development process usually proceeds, and it finds no interference from the external formative agents for embryonic development. Hence, Roux left the external formative agents unimportant. Roux showed the destruction of one of two 'blastomeres' during the zygotic cell division with a hot needle that did not lead to a half embryo to prove the internal cleavage process. There was still some overall control exerted by the whole embryo over its constituent parts. He concludes that embryos are not a complete 'mosaic of self-differentiating parts, and each cell possesses a unique 'reserve endoplasm' that kicks start if an injury occurs.

Later, Hans Driesch discovered that such mosaic development could happen in some species, but he traced the existence of 'regulative developmental patterns.'¹³ during embryonic development. In other words, Drieck suggested that an organism maintains its integrity and autonomy during its development through its capacity to self-regulate. Driesch experimented on sea urchin eggs as he knew that urchin eggs would cause their cells to separate if it is shaken. Drawing from his experimental observation, Drieck traced the importance of regulation. Driesch adopted 'Aristotelian entelechy'¹⁴ to explain the developmental process of an organism. Entelechy is an innate vital force that helps organisms develop and become complete. Drieck's use of entelechy adopted vitalistic thinking, which most of his contemporaries did not accept. Driesch's metaphysics created a doubt that left the preformationist question unanswered: To what extent are parts of a fertilised egg determined to develop into a specific pattern? Roux and Drieck's approach failed to answer how differentiation occurs during cell division in the development process. Researchers and scientists like Edmund Beecher Wilson and Thomas

¹² Nucleus is the component of a cell that is defined as a double-membered organelle which contains the genetic materials or chromosome
s.

¹³ Regulative developmental patterns are the regenerative capabilities of an organism during its cell division of time in its early development period

¹⁴ Aristotle, in his *De Anima* (on the Soul), used the entelechy or first entelechy of the living organism, which, according to him, works as a synthesis of inorganic substances of the organic form of life which is required for the development of an organism

Hunt Morgan did the same experiment with different organisms. They found Driesch's regulation to occur in some cases, while others validated Roux's differentiations.

In the meantime, German cytologist Theodor Heinrich Boveri (1862-1915) also performed his experiment on sea urchins and an unfertilised egg. Boveri observed that chromosomes in the nucleus carry hereditary information, and some form of 'determinants' lead to organism development. Boveri hypothesised that 'those chromosomes which carry whole nuclei have the full capacity to develop into a full organism and those do not contain any, cannot develop at all (Mentioned in Maienschein, 2014, p. 76). In his 1889 work, Boveri developed a hybrid by combining two cells from two distinct sea urchins and discovered clear differentiation between them. From this experiment, Boveri concluded that the nucleus inside the chromosome directs and determines development. Though many did not accept this Boveri result, it opened up further research to discover if the nucleus, cytoplasm, chromosomal determinant, regulatory response, and internal or external factors drive development. Towards the end of the nineteenth century, in 1896, in his book *The Cell in Development and Inheritance* (he dedicated to Boveri), Wilson added the role of chromosomes in early cell division.

Similarly, German physiologist Jacques Loeb (1859-1924) researched sea urchin eggs and accidentally discovered the development of life 'parthenogenetically.'¹⁵ Loeb's discovery was labelled as 'virgin birth' by his contemporaries, where the female egg is given all the credit of a cell division to embryo development. That means the agency of life formation is given to the female egg. This research questioned each parent's relative role and fertilisation's role in a normal environment. Despite criticism, Loeb's parthenogenesis was one of the first to accept the possibility of constructing embryos in the laboratory or making a version of a 'constructed embryo' (Maienschein, 2014, p. 79). Later, this constructed embryo became more common in the twentieth and early twenty-first centuries (ibid).

Further investigation started to raise questions about understanding how two cells (both egg and sperm) become one if both the cells brought their chromosome to a union. Furthermore, how do chromosomes avoid doubling in number every time? How does that process happen? Is it a mechanical or chemical process combining the material between the two cells? These were the central questions debated among physiologists and biologists like Frank Lillie and

¹⁵ Parthenogenetic is a process where asexual reproduction occurs in a normal condition, and the embryo develops without combining the egg with sperm. This form of reproduction is mainly observed among the lower species, like sea urchins in this case.

Ernest Everett Just in the early twentieth century. Frank Lillie developed a theory that emphasised egg interactions with its environment. Besides, Ernest Everett Just discovered that as a chemically active agent in fertilisation, the egg produces a substance or what they call 'fertilising' to attract the sperm to start the fertilisation process (ibid., P., 80).

Similarly, Loeb's theory emphasised the factors internal to the egg. During that time, Morgan earned a Nobel prize in genetic study, though he studied embryology. Morgan developed regeneration research that tried to unfold how development works, and he discovered the role the chromosome plays in heredity. Morgan experimented on various organisms using different methods and concluded that regeneration occurs through internal factors, which are helpful for the organism to grow and develop (Sunderland, 2010). Morgan was among those American biologists who rejected simplistic Darwinian ideas about natural biological phenomena. Morgan also rejected Weismann's theoretical interpretation.¹⁶ For Morgan, regeneration capacities do not need any exceptional environment and are part of normal developmental processes that need to be observed through empirical investigation. Morgan discovered that heredity does not determine cell fate; cells can reorganise with other cells (through transplantation) to provide standard body parts (Maienschein, 2014, p. 85). Against an evolutionary interpretation of organism development, Morgan offered a 'very developmental, dynamic, internal interactive interpretation' (ibid). During Morgan's study, the agency determined life shifted to the internal mechanism of cells, i.e., to gene and their interaction with other tissues. Morgan's discovery left a question unanswered, i.e., 'If cells change in response to the environmental condition of their neighbouring cells, then why could genes not change as well?' (ibid).

Following Morgan, Harrison and the German embryologist Hans Spemann complemented and added extra perspective to studying cells and regeneration using transplantation techniques. Though their research was based on analysing the regeneration of cells, its primary objective was to understand the developmental process of lost tissue or cells, thereby discovering the organism's development (ibid, p. 88-102). Both Spemann and Harrison experimented with the controlled conditions of the laboratory. Harrison and Spemann researched separating parts of

¹⁶ Weismannian theory on hereditary, also known as the germplasm theory, was developed by the German biologist August Weismann towards the end of the nineteenth century. This theory suggests that hereditary information is transmitted from one generation to the next through specialised germ cells that contain all of the information necessary for the development of an organism. Weismannian theory also suggests that the parts most likely to be injured have the natural capacity to regenerate on their own.

frog embryos to see development through transplantation studies. Spemann observed that embryos do not regenerate when the piece is removed in some circumstances. Still, they sometimes regenerate and develop into an entirely different embryo. Their further research inclined towards understanding that substance gave the separate cells the capacity to organise and grow as an additional embryo.

The search was to discover the internal factors determining the development of the whole organism. Spemann observed from his blastopore that it could be a set of special cells that induced the development of the entire organism. In the meantime, Harrison did a few transplantation experiments on tissues outside the organism in an external culture. His primary objective was to understand the complex nervous system and see how the nervous system makes all connections work in the case of epigenetic or gradual development. Harrison transplanted the neuroblast cells of frog embryos and placed them in a culture medium in a glass dish, borrowing the required techniques from bacteriology. Between 1907 and 1910, Harrison concluded in some of his papers that nerve fibres could grow outside the embryo, contrary to the previously held belief that these cells are an integrated predetermined nervous system. Harrison's experiment was the first ever successful tissue culture experiment where the neural stem cells (as they are called so later) lived *in vitro* (in the glass pipe) rather than *in vivo* (in the living body). The late nineteenth-century and early twentieth-century experimental embryology, including Boveri's observation on chromosomes and nucleus, Wilson's cell lineage, Morgan's regeneration, Spemann's transplantation, and Harrison's experiment on tissue culture, yield a detailed picture of the developing embryo by the 1930s. The middle of twentieth-century research drew their attention to the studies of regeneration and repair of injury to understand how tissues adapt to the changing circumstances to regenerate and grow. At the same time, French surgeon Alexis Carrel adopted Harrison's method of placing cells *in vitro* to cultivate tissue from chick embryos. Carrel performed experiments on various organisms' embryos to understand the tissues for medical transplantations. Carrel laid a significant place later to study living cells *in vitro* in isolation from the complex environment of the body. Though his claim of the 'immortality' of cultured tissues was problematic, his techniques of studying tissues *in vitro* contributed to the later development of cell culture used for medical research and embryo development *in vitro* (ibid. p. 95-98).

A further question arises to understand what causes differentiation between the cytoplasm and the role of genes and environmental conditions. Furthermore, what causes cells to grow to a particular kind of cell, and how did cells develop and differentiate as nerves? Eventually, it was

found that the growth factors of cells to become a differentiated nerve became a complex system and that it added to the understanding of how embryos develop (ibid. p.99). The discovery of factors leading to the growth of nerve resulted into Nobel Prize to Dr. Stanley Cohen and Dr. Rita Levi-Montalcini. Though prominent German-American embryologist and neuroscientist Viktor Hamburger had collaborated his research with Rita Levi-Montalcini, he did not receive a Nobel prize. Hamburger's failure to receive a Nobel prize during that time raised many controversies (Ribatti, 2016). Viktor Hamburger and Montalcino, along with Stanley Cohen in 1953, discovered the amino acids that create the protein leading to cell growth. However, this research helped expand the material development and differentiation process. The discovery of a protein in the late 1950s allowed the body to determine if cells are its own or if they develop from foreign sources. Eventually, scientists discovered that a body part or cell, if separated, can create a distinct organism through regeneration. Though this discovery proved possible in lower organisms like Hydra, that possibility was hard to imagine among individuals and other mammals.

The search for making life, particularly making human life possible outside the body, continued until embryologists and geneticists started taking an interest in studying the evolution process and its direct connection with development. James Watson, American molecular biologist, geneticist, and zoologist and Francis Crick, English molecular biologist, biophysicist, and neuroscientist discovered deoxyribonucleic acid (DNA) in 1953. They received the Nobel prize in 1953 for this discovery. Later, this discovery of DNA led to the copying of mechanisms for studying genetic material. Watson and Crick suggested that the chromosomes are made up of DNA with two strands of the molecule wound around each other and that this unravelled the reproduction. The discovery of a protein in the 1950s allowed the body to understand whether cells are one's own or from a foreign source (mentioned in Maienschein, 2014, p.103). In other words, with the discovery of proteins, it was possible to identify whether cells grow with their internal logic or develop from external factors like the surrounding environmental factors. With the advancement of bioscience, transplanting body organs like kidneys was possible, but it could not help transplanting body cells to a foreign body to create another life.

Synthesis of genetics and germplasm: Development of IVF and engineered technologies

The early and middle of the twentieth century saw genetic and molecular revolution. During the beginning of the twentieth century, a common consensus emerged that believed 'the controlling factor in organismic development was due to both cellular interactions and

determinants inside the cell' (Moore et al. 1987, p., 513-515). Metaphors like the genetic program, gene-centrism, and genetic information majorly fit into the modern materialistic preformationism doctrine. They perceive the genome as the organism which carries all the required information to develop into an organism. Modern preformationism does well with Mendelian genetics. On the other side, epigenesis doctrine finds its ideas to be matched (if not completely) with the Weismannian theory on hereditary or germplasm theory. The developmental biologists of the twentieth century favoured a 'genetic decentralisation' and shifted their focus on understanding interactions between genes, cells, cytoplasm, and organism substances from the environment (Van Speybroeck & Van De Vijver, 2002, p. 33). Alongside, non-mendelian or cytoplasmic inheritance research was also in the flow. American biologist Tracy Sonneborn (1905-1981) exhibited the importance of this 'non-mendelian or cytoplasmic inheritance' and discussed its relationship with development (Maienschein, 2014, p. 110). In the mid-twentieth century, in 1940, Waddington coined the term 'epigenetics,' which brought a middle ground between the developmental approach of epigenesis and the hereditary inclination of preformationism.

Epigenetics is the synthesis of epigenesis and genetics. This term, however, blurred the dualistic approach between gene centrism and a process-centred developmental approach. In other words, it denotes a true synthesis between the developmental process and genetic action that brings the organism into being or existence. Waddington's epigenetics constructs the synthesis of epigenesis embryology and preformationist genetics (Van Speybroeck & Van De Vijver, 2002). During this time, the agency of life formation moved from the binary relationship between the preformed organism's whole and gradual development process to the synthesis of both.

Twentieth-century scientific curiosity and the eagerness of women to have babies made the invisible embryo become 'visible and biologically real' (Maienschein, 2014, p. 140). Embryologist Robert Edwards and physician Steptoe finally developed in vitro fertilisation (IVF) in 1978. As a student of Waddington, Edwards started his initial research on mice during the 1950s. In collaboration with his partner Ruth Fowler, Edwards took up the challenge of getting female mice to produce a more significant number of eggs, which would help them control different variables in making comparisons among eggs. They experimentally used hormones to stimulate mice to produce more eggs. This process they called 'superovulation'. From 1957 to 1958, Edward visited the California Institute of Technology (Caltech) to study developmental biology, mainly to understand embryos' and mothers' immunological responses.

After returning to the UK, Edwards experimented on rabbit embryos to study the process of release of eggs from the ovary and the probability of culturing eggs *in vitro*. Though Edwards published several papers about his experiment, this did not get recognised in the stem cell field—the failure to execute scientific ideas due to the unavailability of tools delayed IVF from coming to fruition. The further challenge for Edwards was fertilisation in the laboratory, particularly to 'capacitate' the sperm (ibid). The physician Patrick Steptoe (1913-1988) supported Edwards in helping infertile couples have their 'genetically connected babies' using laparoscopy to extract eggs successfully. Steptoe and Edwards worked together to process extracting eggs, collecting sperm, and fertilising the eggs with sperm 'in the dish.' The first successful IVF cycle took place after multiple trials. This one successful IVF cycle has not been free from challenges. Edwards received rejections of his grant applications, difficulty in obtaining human eggs, and has explicitly faced ethical and political criticism until the time the first fertilised egg was implanted into Lesley Brown in the United Kingdom for the first successful IVF in humans (Maienschein, 2014, p.145).

Louise Brown, the world's first IVF child, was born in 1978. Edwards died on April 10, 2013, a few years after receiving the Nobel Prize in 2010. Later, his innovation of IVF techniques became a major 'medical enterprise' in the United Kingdom and worldwide, adding many assisted reproductive technologies and biomedicines within its network. Few of these medicines and techniques used in IVF procedures are Gonadotropins, Techniques of Oocyte Retrieval, Laparoscopy, technologies used for doing Ultrasound/Ultrasonographical Guided Procedure, Gamete Intrafallopian Transfer (GIFT), Male Factor and Sperm-Recovery Techniques like Intracytoplasmic sperm injection (ICSI), Ovulation Induction, Assisted Hatching, Blastocyst Culture, Preimplantation genetic testing (PGT), Preimplantation genetic diagnosis (PGD), Preimplantation Genetic Screening (PGS)/ Preimplantation Genetic Testing for Aneuploidy (PGT-A), Frozen Embryo Transfer (FET), Donor treatment (Third party donor insemination) that includes Donor oocyte, donor embryos, Hysteroscopy, Endometrial Receptivity Analysis (ERA), Karyotyping etc.¹⁷.

By the 1980s, there was much clarity about the complex process an egg goes through for fertilisation. During the fertilisation process, a sperm cell joins the egg. It is difficult to mention a particular moment of 'conception' because of the complexity of the process. The cell begins to divide after fertilisation and reaches the final stage of embryo development, i.e., the

¹⁷ For details on these techniques and medicines, see Appendix I.

'blastocyst.' The latter has a layer of single cells arranged around a hollow ball, partly filled with a mass of cells called the 'inner cell mass' (ibid. p.147). The blastocyst stage for humans occurs from five to fourteen days.

Lennart Nilsson, the Swedish photojournalist, was the first to take a photo of the human embryo at its early stage of development using medical laparoscopic techniques and an endoscope. Nilsson made human embryos visible to the public (ibid.). He published the picture in his book *A Child Is Born*, which was published in 1965. Later, in 1982, Nilsson's documentaries like *The Miracle of Life* (1982) reinforced the question of the human development process. Critiques have seen Nilsson's image of the embryo essentially leaving the mother out of the picture. In other words, in Nilsson's picture, the 'fetus floats independently of a mother, an autonomous individual needing nothing beyond itself' (mentioned in (Maienschein, 2014, p. 150). The further question was then to understand whether an embryo is an independent entity that grows independently or relies on the mother who carries the embryo to term. Indeed, an embryo cannot grow independently and would remain a parasite without nourishment from the mother. Therefore, women were given some agency to control embryos or life in their bodies, mainly after the '*Roe v. Wade* verdict.'¹⁸ In *Roe v. Wade*, the U.S. Court treated the embryo as part of the mother's body. Therefore, women were given the reproductive right to keep the embryo or to abort it. This verdict, however, opened the discourse of women's reproductive rights and agency of the embryo in general in IVF treatment in cases like *Davis v. Davis* in 1992 and *Roman v. Roman* in 2006 in the U.K.¹⁹ The development of reproductive and assisted reproductive technologies (ARTs) caused increasing medicalisation of women's bodies. Feminist critiques of the medicalisation of women's bodies critiqued the technology as it raised ambiguities about women's agency in choosing this kind of technology both in the developed and developing world.²⁰

The history of ontology of life, which is discussed in this chapter, enabled us to understand how perception and ideas about the origin of life shifted historically from mere speculation to scientifically creating life in the laboratory. The later development, i.e., the innovation of IVF,

¹⁸ For details of *Roe v. Wade* see Maienschein, J. 2014. '*Embryos Under the Microscope: the diverging meanings of life*'. Harvard University Press Pp. 155-161.

¹⁹ See ibid for details of *Davis v. Davis* and *Roman v. Roman* case. Pp- 163-167.

²⁰ Since this chapter aims to understand how agency shifts in the formation of life, the social aspect of embryonic construction and its social and political consequences have not been discussed here. The details of feminist critiques of the medicalisation of women's bodies and ARTs have already been discussed in chapter one.

became a revolutionary scientific development that brought a major paradigm shift in developmental biology in the twenty-first century. This innovation led to studying the social and ethical repercussions of these technologies. With the birth of Louise Brown, public discussion began about IVF and its implications. The U.K. government was the first state to appoint a Committee of Inquiry into Human Fertilization and Embryology in 1984. This inquiry is popularly known as the Warnock report. Marry Warnock headed this committee and appointed government representatives, social workers, scientists, physicians, and legal and religious representatives. This report developed guiding principles for controlling and regulating IVF technology and its social implications. During the debate regarding the ontology of life and the agency of making continued among various social scientists, ethicists, etc.,

IVF technology grew further from the conventional form that aimed only to help infertile women achieve motherhood to making 'designer babies.' Today, there is an increasing number of assisted reproductive technologies (ARTs) added to the IVF network, which are used to increase the success rate of conception and to create life according to the choice of prospective parents. Innovating new technologies within the IVF treatment stimulated new responses from the public. The later development in IVF is popularly known as an advanced form of IVF (as doctors mostly use advanced IVF in today's practice).

Discussion

The development of Assisted Reproductive Technologies (ARTs), including In Vitro Fertilization (IVF), has been influenced by different scientific paradigms and philosophical debates surrounding the nature of life. One central debate revolves around whether life is preformed within the egg or sperm or if it emerges gradually during development. While these perspectives seem distinct, they often overlap with the views of scientists and philosophers throughout history. Initially, the origins of life were attributed to a teleological entity, but subsequent theories shifted towards vital entities and eventually to rationalistic and empirical approaches. Experimental limitations prevented extensive research on mammals until the nineteenth century. In contrast, the twentieth century saw significant advancements in embryonic manipulation and the integration of social factors through technologies like Preimplantation Genetic Screening (PGS) and cloning.

At the beginning of the seventeenth century, the macroscopic era was defined by the principle of rationalism. Therefore, that period of discourse on forming life or organism was mainly borrowed from middle age philosophical principles like Pythagoras, Aristotle, and

Hippocrates. The agency of life formation was assigned to some vital entities. Vitalism continued to influence the debate of preformationism and epigenesis for centuries, even after the development of IVF. In the latter condition, humans control life formation in the laboratory. The microscopic era of seventeenth-century scientific inquiry was androcentric. The scientific investigation of the time was socio-culturally shaped, and preformationism ideas were a culture-laden term.

Regarding agency, preformationism attributed the development of new life solely to preexisting structures within the egg or sperm. The agency of developing organisms was not considered significant in this theory. Instead, the role of development was seen as the simple enlargement and unfolding of the preformed structures. During the eighteenth century, spermists failed to justify their 'physico-theological' explanation of life formation. The rising regeneration theory and epigenesis in the eighteenth century gave some agency to eggs. This resulted in the rise of ovism and regeneration studies during the eighteenth century. This is not to say that preformationism ended during the period. Instead, a shift occurred within preformationism. Preformationists shifted the agency of making life from the vitalist entity and took a materialist position. Material preformationism developed as a critique of the vitalistic presumption of Aristotelian epigenesis. This new form of preformationism emphasises the regeneration of genes but fails to prove the visible occurrence of regeneration. Material preformationism failed to prove its claim because Abraham Trembly and Bonnet (the proponents of material preformationism) aimed not to develop a scientific account of regeneration or genes. Instead, they developed an organic preformation profile of the whole to oppose mechanist epigenesis.

While preformationism continued to be the most dominant doctrine during the seventeenth and eighteenth centuries, epigenesis started to rise in the eighteenth century from the work of Caspar Friedrich Wolff. Wolff's account holds the vital essentialism to be the agent of the gradual formation of life. Unlike others, Wolff's vital essentialism was heavily influenced by Spinoza's natural philosophy. Therefore, the epigenesis account of that time was mainly influenced by German idealism while moving from the previous notion of transcendentalism. Later, Wolff provided a mechanical explanation of life's gradual development, which influenced the nineteenth-century teleological epigenesis. With the advent of German idealism, a move took place within epigenesis. A teleological understanding of epigenesis emerged, assigning the agency of making life from transcendentalism to mechanical empiricism.

Teleological epigenesis continued to raise its claim of assigning agency to natural force as responsible for creating life. Emmanuel Kant supported this doctrine. Kant borrowed the concept of 'Bildungstrieb' (natural force) from his contemporary 'Blumenbach' to support his argument on the role of natural force in creating life. The concept of Bildungstrieb was used as a distinct ontological force that help organise matter for the organism to form. On the other hand, Kant used this concept as an epistemological teleological mechanism. The focus on the natural force remained core to the analysis of most scientists and physiologists to explain the formation and development of organisms. Bildungstrieb became a methodological tool for them. German naturalists and physiologists continued to study the inherent organic process rather than unfolding the preexisting organic forms. Darwin later emphasised a 'common ancestor and natural environment' responsible for creating life. From the late eighteenth century, genetic study became necessary; from this time onwards, epigenesis theory came close to the ideas of evolution theory.

Seventeenth and eighteenth-century scientists focus on vitalism as a methodological stand in biology, particularly in understanding the phenomena of life and life formation, i.e., the formation and development of organisms. Vitalism possesses a *sui generis* characteristic that is different from and distanced from physical and chemical phenomena. Towards the end of the eighteenth century, the vitalist account was criticised as it failed to give an adequate explanation; it restricted the analysis of phenomena to a metaphysical account, which is considered unwarranted by the statement of empirical laws, and it lacks to explain phenomena from a physio-chemical condition. This vitalism was criticised as 'radical anti-reductionism' in the early nineteenth century (Duchesneau, 1985, p. 259).

It is insufficient to say that the seventeenth- and eighteenth-century discourse of life formation was based on the interference of vital force due to disbelief in science and scientific discovery. Instead, this period of history lacked to have sufficient scientific discovery. As observed from the discourse, the social structural forces of the time have affected most scholarly debates enormously. The rise of the materialist approach and the increase of the neo-Kantian approach paved the way for more empirical studies of embryos.

An embryo is no longer seen as a result of a transcendental or natural vital entity. With this advancement in science, German idealism started losing its ground in the scientific debate of embryonic development. From the time of Wilhelm Roux's experiment, the material force from the environment was given the agency responsible for making life, not the mere speculation

on vitalism. The nineteenth century saw a significant paradigm shift in the scientific inquiry of embryonic development as a change occurred in understanding embryonic development. In the nineteenth century, scientific inquiry was emphasised to discover which material things determine life. The agency shifted from mere speculation on vitalism to a more materialist form that can be observed, experimented, and modified.

Meanwhile, German physiologist Jacques Loeb gave full agency to the female egg. Though Loeb's emphasis on the female egg questioned the relative role of each parent, Loeb's parthenogenesis was the first attempt at the possibility of constructed embryos in the laboratory in the twentieth century. Meanwhile, cell theory developed with the emergence of subjects like organic chemistry. The latter helped us understand the chemical reaction in cell and embryo development through cell division. Ernest Everett saw the egg as a chemically active agent in fertilisation. Morgan emphasised that the internal factor pushes regeneration. Against an evolutionary interpretation, Morgan provided a developmental, dynamic interpretation. Overall, Boveri's observation of chromosomes and nucleus, Wilson's cell lineage, Morgan's regeneration, Spemann's transplantation, and Harrison's experiment on tissue culture yield a detailed picture of the developing embryo by the 1930s. James Watson and Francis Crick discovered DNA. This discovery of DNA leads to the copying of mechanisms for studying genetic material. With the discovery of proteins, it was possible to identify whether cells grow with their internal logic or develop from external factors like the surrounding environmental factors. Modern preformationists say humans are nothing but DNA-made flesh.

The genetic factor, believed to carry all necessary information to develop into an organism, did fit well with the modern materialistic preformationist. The study of genetic factors diversified, and gene study also started recognising nonmendelian cytoplasmic inheritance in contributing to organism formation. In 1940, Conrad Hal Waddington developed a synthesis approach between gene centrism and a process-centred developmental approach. To this synthesis, Waddington coined the term 'epigenetic.' This synthesis helped scientists of the twentieth century to understand and, therefore, construct life or embryos outside of a human body *in vitro*. Robert Edward, a Waddington student, conducted experiments on mice eggs with his partner Ruth Fowler to control and stimulate eggs. Edward further experimented on rabbits to extract eggs and culture them *in vitro*. After multiple failures, Edward and the physician Steptoe could extract eggs using laparoscopy and fertilise them in a petri dish combined with sperm. Finally, Edward and Steptoe developed *in vitro* fertilisation through which the world's first IVF child, Louise Brown, was born. Edwards and Steptoe's innovation proved that life

could be created outside the human body in the laboratory. Eventually, engineering technologies like PGS and PGD got some agency in creating life. The development of IVF and the latest engineering technologies like PGD, PGS, and other assisted reproductive technologies made the discourse of agency in life formation more complex as it brought other actors like prospective parents, physicians, state, and social actors' life normative principles derived religion and culture, media, market, etc.

The following chapters bring out a thorough analysis of all the said actors involved in the IVF network through data analysis. The next chapter discusses women's agency in deciding about IVF treatment at different stages and unfolds what shapes a woman's reproductive choices in the techno-medical field. It presents narratives of women respondents.

CHAPTER FOUR

WOMEN'S AGENCY IN IVF: SOCIO-CULTURAL DYNAMICS AND EVERYDAY EXPERIENCES

In the previous chapter, the capability of humans in the 20th century to create life within a laboratory was explored, marking the culmination of a prolonged quest to unravel the mystery of life. This historical discourse on the emergence of life unfolded against the backdrop of societies characterised by a diverse array of social, moral, and ethical frameworks. The interplay of these multifaceted perspectives has significantly influenced the process of life creation, particularly within the context of In Vitro Fertilization (IVF) advancements. The initial stages of IVF technology encountered scrutiny from various quarters, including ethical and religious circles. Over time, this technology integrated into the global capitalist framework and became normalised. The assimilation of IVF into the capitalist economy was swift, transpiring in the latter part of the 20th century.

The evolution of IVF technology also kindled debates concerning agency and reproductive choice in Western societies. The matter of who possesses the authority and capability to initiate life, under what circumstances, and in what manner became a subject of contention involving academics, feminist activists, and ethical factions. In this chapter, the focus is on the gendered aspect of the IVF network, delineated through the narratives of women who opt for IVF as an alternative avenue to conceive and give birth to biologically related offspring. Notably, feminist discourse about Assisted Reproductive Technologies (ARTs) predominantly centred on the implications for women's reproductive rights, particularly within Western feminist discourse. The core concern among Western feminists was the preservation of bodily autonomy, which formed the foundation for advocating women's reproductive rights (Mies, 1988). However, the voices of South Asian women regarding reproductive choice remained somewhat marginalised in the broader Western feminist dialogue until some scholars joined the ranks of the Feminist International Network of Resistance to Reproductive and Genetic Engineering (FINRRAGE) movement. Distinct from the Western context, South Asian feminist conversations gravitated towards the contextual realities of women's lives. This perspective recognised the intricate integration of reproductive choice within the socio-cultural fabric, a dynamic particularly noticeable in South India (Riessman et al., 2002).

Although Indian society was known for its stringent anti-natal policies, IVF gained significant traction due to the pro-natal tendencies of the culture. Within this cultural milieu, women often

assume the role of family torchbearers responsible for continuing familial lineage. In this context, infertility, especially the inability to bear a male child, carries a societal stigma (Bharadwaj, 2003). Conversely, motherhood, especially the birth of a male child, bestows high social status upon married women (Sangari, 2015). Furthermore, achieving motherhood is revered as the pinnacle of virtue in a woman's life. Within this intricate interplay of gender, conception, reproduction, and technology, this chapter explores how aspiring mothers, as central figures, construct their understanding of conception, reproduction, and motherhood within the realm of infertility treatments in the gendered space of the IVF network. This space is deeply rooted in socio-cultural and political frameworks. In the gendered space of the IVF network, giving birth to new life is entangled with scientific concepts, technological intervention, individual aspirations, societal expectations, and a tapestry of cultural and moral values.

Women and their reproductive role in India are metaphorically expressed as 'seed and earth' (Dube, 1986 in the context of central and eastern India). A similar expression of 'cultural conception' is evident across many geographical regions in ethnographic work ranging from Khasi tribal communities to the Kashmiri Pandits (Madan, 1981) and from Gond (Dube, 1956, mentioned in Bharadwaja, 2016) to Bengali kinship studies (Fruzzetti et al., 1976; Tyler et al. 1980). Scholars like N.N. Bhattacharya (1977) across India actively study the metaphorical analogy demonstrating a strong relationship between female biology, the mother goddess, and nature, primarily within Hindu mythologies (mentioned in Bharadwaj, 2016). Scholars mentioned in their work that women actively equate their reproductive role with Mother Earth or soil while actively naturalising and idealising the pain associated with reproductive processes (Dube, 1986). The motherhood ideology deeply embeds the reproductive role of women, which Dube refers to as an "idealised role" (Dube, 1986, p. 42), and serves as the basis for measuring a woman's status and constructing her identity (Dube, 1988; Sangari, 1993).

In this socio-cultural space, this chapter unfolds how gender roles, social expectations, and personal desires determine women's agency in choosing IVF. What does it mean for women to create life through assisted reproductive technology? In Indian society, where fertility holds the most elevated status for women and infertility, and its medical persuasion is considered a stigma, how do women choose to conceive through the assistance of IVF? The chapter endeavours to address specific inquiries by acquiring data from women opting for in vitro fertilisation (IVF) as a viable means of conception within the context of Hyderabad. The thematic framework adopted in this chapter predominantly centres on the nuanced

understanding of choices exercised by women across distinct phases of the IVF process. The emergent thematic categories derived from women's narratives encompass multifaceted dimensions, including social constraints, maternal experiences, moral obligations, familial responsibilities, social support structures, bodily encounters, societal stigmas, and the subjective experience of pain.

This chapter of the thesis presents the narratives collected from the field. It explores the increasing trend of Indian women opting for in vitro fertilisation (IVF) to overcome the biological limitations of infertility while shedding light on the social, cultural, and personal factors contributing to reproductive choice. Indian society is heterogeneous, with different castes, classes, ethnicity, and gender. This chapter delves into respondents' (women's) reproductive decisions within assisted conception. It unravels respondents' diverse experiences and decision-making processes from various socio-economic backgrounds as they embark on their desired paths toward prospective motherhood through IVF. Through a thematic exploration of respondents' narratives, this chapter sheds light on the lived experiences of those undergoing IVF treatment, offering valuable insights into their journeys.

Section-I

Conceptualising biological lack

By seeking medical and technological assistance at fertility centres, women inherently acknowledge a perceived insufficiency within their bodies, necessitating intervention through medical technology. In this context, "in-fertility" or "sub-fertility" are viewed as medical conditions requiring biomedical interventions. The traditional perception of pregnancy and childbirth as embodied experiences of pleasure has shifted, with IVF transforming pregnancy into a medicalised process that involves technological interventions on the reproductive body. The narratives of women respondents consistently refer to infertility as a 'biological lack' or a medical condition. This chapter conceptualises the notion of 'biological lack' or "medicalised embodied infertility" (Johnson et al., 2012) as a bio-social construct within the context of infertile women seeking IVF treatment. The term 'biological lack' refers to the inability to sustain or conceive a pregnancy due to various medical conditions. However, social and cultural values influences play a significant role in shaping this concept, and biological factors do not solely influence it. While infertility is often presented as a medical condition, emphasising its physical aspects, the process of medicalisation further reinforces the notion of biological lack by framing infertility as a deviation from social and cultural norms (Inhorn &

Birenbaum-Carmeli, 2008; Dudgeon, & Inhorn, 2003). Women seeking IVF treatment perceive this construct as their inability to conceive aligning with societal expectations of motherhood. Consequently, their bodies become the focal point of their experiences. These women experience the inability to conceive and carry a pregnancy as a bio-social condition that significantly impacts their sense of self and embodiment. Throughout their IVF journey, women's bodily experiences reflect the absence or lack of reproductive capabilities that are expected and valued within their social and cultural contexts (Merleau-Ponty, 2012). By recognising their bodies as 'bio-social constructions,' women consciously opt for IVF technology as a choice.

As reiterated in their narratives, the perceived lack experienced by many women arises from a bio-social condition resulting from various factors such as advancing age, adoption of a consumeristic lifestyle, inherent genetic issues, fallopian tubal blockage, or unexplained infertility. In the face of this lack, assisted reproductive technologies (ARTs) serve as markers of temporal inevitability, allowing women to subvert the notion of reproductive decline (Majumdar, 2021; Daly, & Bewley, 2013). Women choose these technological solutions to reverse the effects of their biological clock and temporarily address the perceived biological lack experienced during their reproductive years or beyond (ibid). In the context of assisted conception, it is essential to note that the definition of reproductive decline does not solely confine age. Instead, it actively understands age as a transient and malleable concept that can be subject to manipulation.

The process of conceiving and giving birth to a biological and genetic child is confined to an "hourglass" by biomedicine and assisted reproductive technologies (Majumdar, 2021). Ageing and timing, in this context, are shaped by both biological and social factors. In assisted conception, age goes beyond a mere chronological measurement since birth; it encompasses a complex interplay of biological processes and social expectations. Scholars like Gilleard and Higgs (2007) have explored how age becomes a social marker that influences individual identity and interactions within social structures. Additionally, as discussed by Conrad (2005), the concept of medicalisation highlights how infertility and its treatments, including IVF, are influenced by social factors and norms. Within this framework, age is often medicalised and associated with biological decline, leading to a perception of "lack" or diminished fertility potential. Women who undergo IVF or choose technological assistance for conception perceive unexplained infertility as a personal biological deficiency. This perception is particularly prominent among individuals who, after a certain period following marriage, have been unable

to conceive without receiving a specific medical diagnosis for their infertility. Unexplained infertility, in other words, does not fit into the category of medically defined infertility.

Additionally, cultural and social pressures regarding family honour contribute to the association of male infertility with stigma. As a result, women often feel culturally and socially bound to shoulder the blame for infertility. They may choose IVF as an alternative option for conception, either voluntarily or due to external pressure. The study findings indicate that women perceive this biological deficiency as a biosocial issue that necessitates a technological solution. Assisted reproductive technologies (ARTs), including in vitro fertilisation (IVF), hold the promise of assisting women with overcoming this biological lack and achieving conception. Medical practitioners play a crucial role in fostering this sense of hope. At the same time, information about IVF is widely disseminated through various social media platforms, making the technology accessible to individuals residing in big cities, small towns, and even rural areas. Women interviewed for the study exhibited varying knowledge about IVF and its functioning. Educated women acquired information through doctors, the internet, research articles, and friends, conducting thorough investigations before selecting the treatment method.

Similarly, women with less education, particularly from rural areas, learned about IVF from doctors, friends, or relatives. However, regardless of their sources of information, they commonly viewed infertility as a lack, specifically a biological lack, which they believed needed correction through biomedical means or biotechnology, such as IVF. The perceived natural or biological lack is the primary motivating factor leading women to choose IVF as an alternative option for conception. Women who undergo and struggle with IVF actively emphasise the exercise of their autonomy, establishing their identity, and asserting their moral agency throughout their conception journey.

Women undergoing IVF treatment perceive their bodies as more than static biological objects. Instead, they view their bodies as "lived bodies," significantly influencing their perception, actions, and understanding of the world. The lived body is a perceptual and expressive entity that shapes women's experiences, sensations, gestures, and overall perception and understanding of their world (Merleau-Ponty, 1996). Within the lived world of women, societal expectations regarding the right time and age for marriage and conception construct meaning. Women who cannot fulfil these social expectations may opt for IVF as an alternative that promises to help them achieve their desired societal outcomes. Women express their subjective experiences related to conception, giving birth, and deciding to pursue IVF. The social world in which women exist and create meaning in their everyday lives shapes these experiences

rather than them being merely individual cognitive behaviours. Women's experiences with IVF procedures have been discussed below under different themes. For his chapter, twenty-six women's narratives were discussed to provide a comprehensive perspective. Different narratives of a single woman have often been used under distinct themes.

Biological lack: Negotiating autonomy with reproductive capability through technology

In the feminist discussion surrounding women's reproductive agency, radical feminist scholars appear to hold a more polarised view on the potential impact of assisted reproductive technologies compared to liberal feminist scholars. Radical feminist scholars argue that modern science and technologies, seen as objective and devoid of values, may diminish women's autonomy and subject them to the control of patriarchy and capitalism (Mies, 1988, 1993; Ewing, Klein, 1989). On the other hand, liberal feminist scholars advocate for the benefits of modern science and technology, including assisted reproductive technologies like IVF. From a liberal feminist perspective, these medical technologies can empower women by granting them greater autonomy in controlling their reproductive choices (Stanworth, 1987; Rothman, 1989). Postmodern feminist scholars later presented a similar argument, suggesting that such technologies could help women overcome biological limitations or what could be referred to as biological lack when it comes to conceiving (Sandelowski, 1990a; Shildrick, 2015). However, it is essential to note that, as discussed in the first chapter of this thesis, the feminist discourse on women's autonomy concerning reproductive choices through assisted technologies has certain limitations. These discourses, however, often fall short of comprehending women's experiences and perspectives from grounded reality.

In this section, the researcher explores how women navigate the challenges of their biological limitations and the quest for autonomy in the face of societal expectations and their innate desire for motherhood. Based on narratives and personal accounts, it is argued here that IVF does not provide complete autonomy for women to make their reproductive choices freely, nor are women entirely liberated from social constraints in achieving motherhood. Instead, the researcher contends from respondents' narratives that women can negotiate their autonomy within societal expectations. While women discussed in this theme choose their careers and the timing of conception, cultural values embedded in their social world still influence these decisions to become mothers at a certain age. Their reproductive choice is intertwined with regret, guilt, and cultural confirmation. Women's reproductive choices are shaped by a "cultural

construction of continuity" that demands confirming cultural norms, even if they enjoy a certain level of autonomy due to their socio-economic status (Becker, 1994, p.383). It is argued here that women's autonomy in the context of reproductive choices is not solely individualistic or self-oriented but rather intertwined with cultural values and expectations. Below are a few narratives of women who are navigating their reproductive choices while balancing their autonomy with societal expectations:

Malti (pseudonym), age 29, married for four years, belongs to the Hindu OBC caste, originally from Visakhapatnam, Andhra Pradesh, and lives in Hyderabad with her husband. She works as an Assistant Professor in an engineering college that happens to be close to the IVF centre; she is doing her 'infertility treatment.' She views age as both a biological condition and a social reality, where modern-day working women are expected to give birth by a desired age, specifically before turning thirty. For women like Malti, adapting to a modern job and spending much time outside, she sees a new lifestyle as a reason for her biological lack and her decision to delay pregnancy until she reaches her late twenties. She said:

I have been married for the last four and a half years. Two years after my marriage, I checked with the doctor regarding fertility issues. It was evident that when we went to the doctor, they started doing some treatment. So, they started with something called ovulation induction. But that did not work, so the doctor suggested Intrauterine insemination (IUI). I went for IUI first. I did two rounds of the IUI cycle. But that also failed. Following the doctor's advice, I underwent tests such as hysteroscopy and laparoscopy, but no significant problems were identified. So, I thought of taking a gap of six months. I was not in a hurry. After six months, I started IVF. Then, I did all the required tests. Now, the test report says that the quality of my eggs is not good, and the egg reserves are very low. So, I went for all the required blood tests to know the anti-mullerian hormone (AMH) level before doing IVF. Previously, I was advised to take all the tests, but the doctor had said that I was still in my reproductive age. So, she advised me to try to conceive naturally. There, I took a gap. But now I realise I will turn thirty-one in another two years. Already, my body lack something because of which I failed to conceive. My egg qualities are decreasing due to my age. Before my age created any other problem in my body (reproductive body), I thought it was better to do IVF. And that 'age' itself will be a problem. So, I decided to start IVF now before I turn the age of thirty. It is not easy to do IVF while hiding it from family members. I have changed my workplace. I had been working in an engineering college in the other part of the city. To take IVF treatment, I changed my college. These days, I am teaching at a college near this hospital. I must manage money as well for this treatment. My husband's money is not enough for our living. Everything is expensive now.

Anjali (pseudonym), aged 32, married for eight years to her cross-cousin. She belongs to the upper-caste Hindu community. She runs her own IT firm in the city. Despite having success

and good family support, she still thinks achieving motherhood is supposed to be the most important goal of a woman's life. Regarding age and IVF, she said,

I have spent most of my time and age building my career. But I regret that now. Because of the delay, I have developed some health issues like endometrial problems and tubal blockage that are causing me infertility. Women need to give birth at a certain age. While recognising the importance of a career, I now understand that it can be pursued later. However, delaying the childbearing age will result in consequences that must be faced. But thanks to the advanced technologies that we have nowadays. It is because of IVF I am successfully pregnant now. But I would suggest conceiving naturally at the right age is better. My family is very supportive; we earn enough to live better with God's grace. So, at least we do not have financial stress, which I have noticed among women undergoing IVF.

The above-stated narratives portray a link between different physiological issues and their relation with age as the primary cause for which many women in their early thirties and above age seek technological assistance for procreation. Along with associated medical reasons, age is seen as a time liner between marriage and conception and giving birth (Majumdar, A.2021). Kali (pseudonym), aged 30, has quit her job and lives in Dubai with her husband. She has made an inter-faith marriage. She said,

I have quit my job to plan a family. After all, conception and giving birth to one's own child is important at a certain age. I was not working only for money; my job was my passion. My husband is a doctor but not a gynaecologist, and he is earning well. I was teaching biology to higher secondary students. I had to quit my job for this treatment. But I have no regret because family is also important. Since we are both from related fields, we know our exact problem. I have an ovary problem (in a shallow and sad voice). Because of my age, my egg qualities are not good. My husband has a sperm mobility issue. We know IUI and other treatments will not work in our case. So, why take a chance and waste money? It does not cost a small amount, right? All the treatments are costly. That is why we choose to do IVF instead of trying other treatments. Even my husband has some problems. So, I am a little nervous. We do not have age and time. I must do it now. Luckily, my family is very supportive because they are well-educated and aware of this technology.

Preety (pseudonym), aged 28, married for eight years (endogamy), native of Vijayawada, Andhra Pradesh, is temporarily living in Hyderabad for infertility treatment. She is a B-tech graduate working in a non-IT firm before marriage. She quit her job because her husband did not like her to work. Regarding assisted conception through IVF, she said,

I worked as a mechanical engineer on a private firm in my hometown for a considerable period. However, my husband, who earns a good income, disapproved of my job after

marriage. Initially, I continued working, but when we decided to start a family, he insisted that I quit my job. My family placed the blame on my working after marriage, suggesting that it was the cause of my infertility. Despite undergoing natural conception attempts three times, I have been unable to conceive, despite no discernible issues with my body and inconclusive results from medical tests. As I approach the age of thirty, I have ultimately chosen IVF, which represents the most advanced treatment available for addressing infertility.

Preety initially had a career as a mechanical engineer and continued to work after marriage. However, her husband wanted her to quit her job when they planned to start a family. It looks like Preety's husband is the primary decision-maker at home. This raises questions about gender roles, societal expectations, and the negotiation of work-life balance within a relationship. Though influenced by external factors, quitting her job ultimately affects her autonomy and choices. She faced societal pressure from her family, who attributed her infertility to working after marriage. This narrative reflects the tendency to blame women for reproductive difficulties, often overlooking other factors or medical conditions. It exposes how societal norms and beliefs impact women's experiences and self-perception. As the woman nears thirty and faces infertility, she opts for IVF as an advanced treatment option. This decision underscores the availability of assisted reproductive technologies as a choice for individuals facing infertility. It showcases how scientific and technological advancements provide alternative paths to parenthood and highlights the significance of individual agency in decision-making.

Rekha (pseudonym), aged 30, married for six years (consanguineous) from the Hindu upper caste, originally from Srikakulam, Andhra Pradesh. She has quit her IT job to start her family, i.e., to give birth through IVF after a multiple pregnancy failure. She lives in Dubai with her husband and temporarily lives in Hyderabad city for treatment. She said,

Even though I do not know why I am not conceiving for all these years, I know something is wrong with my body. And I know IVF is unsuitable for our body, but I accept it if that gives me a baby. I have spent enough time making a career. Now, I want to be a mother. It does not matter who has a career; people question me for not being able to give birth till now. That is why I have left my job. I can work later. But my job, for now, is to try every possible way to have our baby, even if it is through IVF and even if I must undergo technological intervention. I can make a career later if needed.

Rekhas's mention of earning money in the narrative implies that the women recognise the financial considerations associated with living life. It also suggests that financial stability is a

prerequisite for motherhood, aligning with prevalent social norms and expectations. It also highlights the economic dimension of decision-making related to reproductive technologies like IVF. By choosing IVF, Rekha employs a technological solution to negotiate the career she perceives in achieving motherhood. The decision to pursue IVF indicates the woman's willingness to utilise science and technology to navigate societal expectations and pursue her desired embodiment of motherhood.

Mitha (pseudonym), aged 30, married to her cross-cousin for five years, belongs to the Hindu OBC group. Initially, she hails from Khammam district and stays in Hyderabad to live with her husband. She works as an IT engineer in an MNC. She has been trying to conceive since the time of her marriage. She has faced many challenges derived from stigmas attached to infertility and age. Having belonged to both rural and urban areas and been conditioned by traditional values and modern work culture, Mitha emphasised conceiving in an ideal age. Failure to conceive many times, even though IVF, has caused extreme anxiety and got her branded as a 'godralu' (barren woman) who has failed to achieve the purpose of his life despite being more successful in her career than her relatives. IVF remains a choice of hope for her to fulfil societal expectations and achieve her embodied motherhood. In her words,

When I did not get pregnant two years after my marriage, my relatives started questioning me. I had arrived at a time when I stopped attending many family functions. I consulted doctors before beginning IVF but was not getting any positive results. It was when I was diagnosed with a partial blockage of my fallopian tubes that the doctor advised me to go for IVF. By then, I had understood that my body was incapable of carrying a child. My family and relatives have made me realise that 'vacuum' in me. People always question me no matter what I do and how much I earn. Making money is also essential to give good to our children in the future. I did not listen to anyone initially because I am an independent working woman. When I was diagnosed with fallopian tubal blockage, my family and relatives, including my husband, doubted my worth and criticised me for my inability to give birth. They have made me realise that I have failed to achieve my life's purpose as a woman. You know, it feels as if I have not achieved anything in life. I have been doing good in my career. Now, because of this treatment, I will lose progress in my career. No one understands that. I also want to be a mother, so I have tried IVF many times over the last four years. But those humiliations that come from my relatives are not bearing. I want to bet on those humiliations I have experienced so far.

From the age of 26 to 30 age, I have tried five IVF cycles. This is the fifth IVF cycle I am undergoing. I hope one day I will be successful through IVF technology. Sometimes, I have thought of taking a break from IVF, but my husband keeps saying that since he has aged, why not try for our baby now without wasting time? He says couples in their 40s are pursuing a child through IVF. So, why not we try now.' That is why I am trying all possible ways to conceive and give birth to our child now before I age more. When I turn

40 and look back to these ten years, I will not regret having the option of IVF, but I did not try. That time, I will not get my age back right! So, we are trying our best now so that we will not regret later that we did not do anything to have our child.

Mitha further added:

Since I work in IT, my doctor said that my lifestyle might have affected my infertility. But what about my colleagues? I have seen many from my office happily conceived and have given birth. I still do not understand how my lifestyle has affected my reproductive body. But whatever it is, I know the doctor cannot be entirely wrong because I have some biological problem.

For all six women respondents, age is about time, i.e., to conceive and give birth before they enter reproductive decline age. Lifestyle is all about a work-life balance in busy city life. Medically certified or unexplained biological lacks are the uncertain realities caused by both age and lifestyle. All three women are educated, ambitious, and passionate about their careers during their early twenties, in the socially considered reproductive age. Anjali and (others) express a shift in perspective regarding the importance of childbirth at a certain age. They acknowledge the significance of reproductive timing and the potential consequences of delaying childbearing. Acknowledgement of reproductive time and career choice highlights women's autonomy and agency in choosing their careers and family planning and the evolving understanding of the importance of balancing these aspects of life. These narratives underscore that natural conception at the "right age" is preferable. This perspective indicates recognition of age's biological and social implications on fertility and the potential benefits of aligning reproductive timing with optimal conditions. This, however, highlights the importance of personal beliefs surrounding the use of reproductive technologies like IVF and the desire for natural conception; for career-oriented women like Anjali and Sonam, social norms and cultural expectations shape their individual choices, perceptions, and experiences. These narratives reflect broader discourses surrounding gender roles, work-life balance, and the expectations placed on women regarding both career and family formation.

In the study, it became evident through interviews that many women who opt for IVF are thoroughly knowledgeable about the technology. Choosing to start their reproduction journey with the assistance of IVF technology did not confirm the 'cultural continuity' (Becker, G.1994). They choose a career after marriage instead of achieving motherhood. This expresses their agency in the reproductive field. However, they made an informed decision to choose IVF

and have tried every other alternative treatment before doing IVF, which is less invasive than IVF.

Transforming biological deficiency: Empowering identity and self-worth via technological advancements

The feminist discourse on motherhood shows that women facing involuntary infertility often experience identity-related challenges. (Letherby, 1999; Wager, 2000; Ulrich, and Weatherall, 2000). Scholars, both in Western society and India, have noted that 'motherhood constituted as the primary role for women, an indistinctly perceived instinct, and a life goal' (Franklin, 1990 and Letherby, 1999). At the same time, motherhood is a crucial identity for most married women in general and Indian women. This identity becomes a measurement of self-worth for many who live a financially dependent life as their economic condition and cultural values determine women's choices. Their life becomes a vacuum or barren field in the absence of conception or without having their 'own' child. While rejecting 'motherhood' notion as a fixed and predefined concept, postmodern and post-structural feminist perspectives propose that Assisted Reproductive Technologies (ARTs) offer opportunities for agency, diverse interpretations of "motherhood," and a positive connection with maternity. Unlike their previous stance of rejecting motherhood as a means to overcome power structures, post-structural feminists now view ARTs, mainly IVF, as a potential tool to challenge and navigate power structures in the context of motherhood. However, based on the narratives examined in this chapter, it may be argued that women neither actively attempt to overcome power structures through IVF nor are entirely free from such power structures. Instead, IVF enables these women to construct identities and preserve their self-worth within the existing power structure. Within this framework, these women utilise IVF as a means of self-empowerment while still operating within the confines of the prevailing power dynamics.

This section of the chapter presents the lived experiences of women who choose IVF when they find themselves at a crossroads. Their decisions and reproductive choices determine whether they will lead an empowered life, maintain their self-worth, or live impoverished lives. Through their narratives, women express how they make technological choices at this critical juncture. Factors such as age, lifestyle, economic dependency, gender roles, class, and culture actively influence their choices.

Mona (pseudonym), who is 40 years old and has been married for twelve years, belongs to the Hindu OBC group. She believes that age is a biological limitation and that IVF technology will help her overcome this limitation. Mona has quit her hostel wardenship job because she is preoccupied with IVF treatment, which requires travelling from Kurnool to Hyderabad frequently. She has been consulting doctors for two years after her marriage. In her infertility treatment journey, Mona has had two miscarriages from natural pregnancy, resulting in her losing both fallopian tubes. After losing both tubes, she had no option left other than doing IVF. She thinks that getting married at a late age poses problems for women. In contradistinction to working women characterising their lifestyle as a biological deficiency, women such as Mona attribute her infertility to factors such as a stressful life and advanced age. In her words,

I got married at the age of twenty-nine. That was the very reason for me to have all the pregnancy-related complications. Otherwise, I do not have any problem. All my pregnancy journey happened in my thirties. It was a time I lost both my fallopian tubes, and I had no age also. At that time, I thought I had lost my life because I had lost all chance of pregnancy. I started blaming myself. It was my fault. My body failed to give birth. I went into depression. I did not know what to do. My husband was supportive, so we did not lose hope. I kept on consulting doctors and came to know about IVF. IVF came into my life like a ray of hope. At that time, IVF was not available in my native place. So, I came to Hyderabad to do IVF. To date, I have done seven IVF cycles but failed to conceive.

I know the reason. I am late in life to plan for a baby, and in the last couple of years, I have taken enough stress and underwent depression. Now I know how incapable I am as a woman. I cannot even give a child to my husband. My husband loves children. So, I proposed to him for adoption. But he (her husband) wants their 'own' child. I also suggested a second marriage to them. But he denied it because he is a nice person. That, again, makes me feel worse. He is compromising for me. But I cannot even give him a child. I had lost hope after all the IVF cycle failures. Then one of my friends who has successfully given birth through IVF suggested me this hospital. This hospital provides facilities like donor egg treatment. So, I have come to this place again with a new hope. I hope IVF will help me this time because I heard that this hospital uses more advanced technologies. I know my family, including me, expected to have a child through natural means. I desperately want to be a mother to create an identity in my society. (Mona: 40)

Mona's self-blame and guilt for failing to marry and give birth at a late age (as defined by her) highlight the social expectations and norms surrounding women's reproductive choices. Her experience showcases the medicalisation of infertility, which significantly impacts her sense of self-worth and identity. The loss of fallopian tubes and the subsequent blame placed on

herself reflect how she has internalised infertility as a personal failure. In this social expectation and self-blame condition, IVF becomes a potential solution for infertility. She chooses IVF as a ray of hope, demonstrating her desire to exercise her reproductive choice despite difficulties. Mona's lived experience illustrates that ARTs can expand the reproductive choices available to individuals, allowing them to pursue alternative pathways to parenthood. Her experience of multiple time IVF failures and feelings of lack (biological lack) shed light on the emotional toll of infertility and the social expectations surrounding women's ability to conceive and give birth. Her desire to adopt and her husband's preference for a biological child reflect the complex interplay between societal expectations, familial desires, and personal choices. Her decision to travel to a different city to access advanced IVF technologies and donor egg treatment highlights the unequal distribution of reproductive healthcare resources. Mona's reproductive decision emphasises the importance of considering the socioeconomic factors shaping access to reproductive technologies and the potential implications for reproductive choices. Mona further reiterated:

For a period, my husband hesitated to consent for me to pursue IVF, concerned that the resulting child might not be biologically ours and considering it to be an unnatural method. However, after doctors provided detailed information about the treatment process, he eventually agreed. Nevertheless, we are aware that this pregnancy journey is not a natural one. Nonetheless, we recognise the need for compromise. (Mona:40)

Mona internalises the meaning of conception as natural and technological assistance in conception as not natural. Her journey toward motherhood engenders conflicts as she grapples with the dichotomy between natural and artificial means of conception.

Like Mona, Greeshma expresses her desire to be a mother as a deep sense of responsibility. She is facing extreme pressure from her family to give birth. She associates conception and giving birth with the purpose of her life. She highlights how infertility 'disrupted her identity as a woman and how IVF technology became a hope technology for her. Greeshma (pseudonym), aged 33, belongs to the Hindu OBC group and has been married for eleven years. She had an arranged marriage within the same caste. In her words,

After looking at our medical history, they (doctors) informed us that we must try IVF. We decided to go for the same. I did not have any other choice. The doctor looked at our reports and recommended IVF treatment. We were already undergoing infertility treatment for the last many years, but no doctor ever found any specific reason. We had no choice. I was answerable to many every time I failed to conceive naturally after a few medications. I am a housewife. So, unlike other women who work, I have no other purpose in life. Almost all women among my relatives are already mothers to at least one

child. I feel very insecure when I see them. It isn't easy to face them. They keep asking me. But health conditions are not in our hands. Whatever it is, giving birth at the right age is essential for me. But I have already crossed that right age.

Most importantly, we have been married for eleven years. So, I decided to go for IVF treatment. How long would I have to wait for a child? I wanted to be a mother at any cost, even artificially. The fact that I conceived through IVF treatment is unknown to anyone in my family except my husband. If they were to find out, there is a possibility that they might criticise me for my choice. But I had no other option left than doing IVF. The doctor told us that there was no point in waiting. We believed in doctors and IVF. Now, I am pregnant with twins for seven months.

In calculating the right and wrong age to conceive, Greeshma finally chose to conceive with the assistance of IVF technology. Greeshma, like millions of married women in India, is confronted with a profound identity crisis within her social sphere. She urged the establishment of an identity primarily through motherhood in this social world. Despite considering in vitro fertilisation (IVF) as an unnatural and morally questionable method of conception, she is willing to pursue it to fulfil the societal expectation of embracing motherhood. The decision to utilise this technological option for conception revolves around the inherent conflicts between the societal pressure to establish motherhood as an identity and the moral dilemmas it presents, conflicting with the prevailing ethical standards of her society. The women whose autonomy in both career and reproductive choices was previously examined express a distinctive emphasis on attaining motherhood as a central purpose in their lives. Rekha's IVF journey implies how important motherhood identity is for Indian women. In her words,

You know, nothing is more painful than not having a baby. What is the purpose of this life and earning money if I cannot become a mother? (Rekha, age-30)

Rekha associates her life's purpose with becoming a mother. This association suggests that she perceives motherhood as a central aspect of her identity and personal fulfilment.

Donor option: Children are born to men out of women

The feminist literature on gender power dynamics debates suggests that the relation of women and motherhood with reproduction is perceived as unproductive. This relegation has granted men authority over various aspects of women's lives. This included control over their biological and social reproduction, children, and employment opportunities. Consequently, this power dynamic enabled men to exploit women for personal, economic, political, demographic, and nationalistic purposes (Rothman, 1994; Ginsburg & Rapp, 1995; Davis, 1997). The gender

power structure is associated with patriarchal ideology. 'In a patriarchal kinship system, children are born to men out of women' (Rothman, 1994). Despite the physiological problem primarily affecting men, women bear the brunt of social pressure regarding childlessness. As a result, they often assume the responsibility of initiating treatment (Greil et al., 1988; Ulbrich et al., 1990; Higgins et al., 1990). In many cases, women cannot pursue donor insemination without their partner's consent (Novaes et al., 1985; Lasker, 1994). The enduring cultural expectation for motherhood makes women more vulnerable to infertility than men (Sandelowski et al., 1990b). Studies conducted in India on donor eggs and sperm found that the overall acceptance of a donor egg is more significant than that of a sperm. Among donor sperm or donor embryos, women's acceptance of both is equal in proportion. But males are more amenable to accept donor eggs than sperm (Banerjee, and Singla, 2018). It is argued in this chapter that women's economic dependency and lack of social support marginalise them from decision-making, including their own reproductive choices. Whether social support exists or not, women's socio-economic conditions and societal expectations exclude them from the core of the reproduction decision-making process.

Reshma (pseudonym), age 48, married for 32 years, belongs to the Sunni community of Islam. She is a homemaker who has lived most of her post-marriage life away from her husband, who used to work in the Gulf. Due to irregular intercourse, Reshma has never conceived in her life. Though she did not delay this conception journey to her wish, she still missed out on her identity as a mother in her big in-law's family. IVF is also bringing her hope to establish her identity in her family. This technology promises to provide old-age support. She said,

I have hardly stayed with my husband. My husband was earning money in the Gulf, and I stayed here in Hyderabad and cared for our property. Since I could not conceive naturally, I made an informal bond with my sister, who agreed to give me one of her kids to raise. But she broke her promise. Then, I tried to conceive and started consulting a doctor. We have no option left. My co-sister (husband's brother's wife) had promised me that they would give us one of their children. I greatly cared for her when she was pregnant with her third child. But after she delivered, she refused to give me the baby. They did not help me, but they never failed to taunt me. Adopting from outside the blood relation is not acceptable in Islam. Then I made up my mind. Otherwise, who will care for us in old age if we do not have a kid? My natal family is supporting me in this treatment. Initially, when the doctor in Bangalore proposed donor treatment, we (including her husband) disagreed. But after a few medical check-ups, doctors said we could use my husband's sperm. Then, my husband agreed. Initially, I did not favour using donor eggs because it is haram in Islam. But it was already too late for me. Finally, I am doing this treatment using donor treatment.

In Reshma's narrative, there is a gendered division of labour where her husband works in the Gulf while she stays in Hyderabad to manage their property. The long-distance nature of their relationship raises questions about the absence of a biological connection and the cause of infertility. The taunting from her relatives actively suggests that value of a woman is synonymised with her ability to conceive children. During a medical consultation, Reshma's husband initially opposes using donor sperm, indicating a prioritisation of male biological lineage. However, Reshma's disagreement with the use of donor eggs shows that her social support provides her with some agency in decision-making. Subsequently, her husband's acceptance of using his sperm but with a donor egg suggests prioritising male kin descent over the woman's biological connection to the potential child. Unlike other women in the study who acknowledge their biological connection to the baby, Reshma is more concerned about her religious beliefs. Reshma's concern for her religious values indicates that her reproductive choices are influenced by patriarchal ideology, which emphasises the biological link between a child and male lineage and her religious beliefs.

Bimla (pseudonym), aged 43, OBC, lives in Sangareddy, Hyderabad, with her joint family. Regarding doing IVF after the age of forty and the use of the donor option, she said,

I got married late, at the age of thirty-two. We struggled a lot financially in the early days of our marriage. In all those years, my husband worked hard to make some money. But in that struggle, we have avoided having a child. Later, when we wanted a child, it was too late. Who does not like to be a mother? But more than that, what bothers me is who will care for me and my husband when we are old. We, husband and wife, struggle to have a child at this age. It isn't easy to live a life without a child. When relatives criticise me, my husband says I do not care, but I live in the house; I face it all. So, I know how painful it is. First, we struggled to make money. I am now struggling to have a child. I have already experienced two IVF cycle failures. I do not know why doctors falsely promise that it will help me become a mother. This time, I am using donor treatment because I have no other choice. I want the child to be born from my womb so I can prove to society that it is my child. Doctors had advised us to use donor treatment during our last IVF, but I disagreed because it, you know, is not good. But this time, I have no other option. (she was reluctant to share her specifics about the use of donor egg, sperm, or embryo).

Like Reshma, Bimla's family faces financial struggles, with her husband being the sole earner. The women's financial struggle highlights the societal expectation of men as the primary breadwinners and women as caregivers (Calasanti, et al., 2006). Bimla's relatives teasing her for not conceiving demonstrates how society often holds women accountable for the inability

to bear children despite them not being solely responsible for the biological factor. Infertility blaming women points to the existence of a power structure within her social sphere, where gender roles in conception are predetermined, and women are seen as unproductive if they cannot give birth. Furthermore, Bimla's discomfort in sharing the details of her donor treatment indicates her moral concerns regarding her and her husband's identity and reputation.

Another woman, Mrs. Reddy (pseudonym), aged 43, said,

I have stayed away from my husband for quite an extended period. He was out of the country to make money. I had to stay here because nobody could take care of our parents. At that time, I adopted some bad habits and developed obesity. But how can that become a problem? I do not understand why doctors blame us for saying our lifestyle has affected our reproductive bodies. What lifestyle do village people have? Why are people from the village coming on a large scale for IVF? Yes, I understand our lifestyle is slightly different, but what can we do? We are so used to it. I accept that it might have affected my reproductive body, but my question is why IVF is still not working. After seven rounds of the IVF cycle, I hope for some good results in his time.

In the second interview, Mrs. Reddy shared details about her marital relationship. In her words,

I do not know why we failed to develop an intimate relationship. I do not understand whether it is because I have put on so much weight or because my husband and I have lived away from each other for a long relationship. But a woman is always blamed for not having a child. No one understands what life I am living. Conceiving and having a child was never in my hands. I am using donor sperm because my husband cannot produce a child. I am sharing my personal information with you because you are an acquaintance. I did not get a divorce from my husband because of my parents. If I had separated from my husband, my parents would have been disheartened by my choice. Even my intention of doing IVF with all the pain is because of my parents. Apart from that, I, at least, want to have someone with whom I could connect and who will be my companion. You know, I have spoken to many women coming for IVF here due to a lack of physical intimacy with their husbands. See, how many women are accompanied by their husbands here? Men do not even show up in the whole IVF procedure. So, it is obvious donor treatment is the only option to conceive.

The narrator's husband is portrayed as the primary breadwinner, while she stays behind to care for their parents. Mrs. Reddy's economic dependency and homemaker role reflect traditional gender roles. In these gender roles, men are expected to be the primary breadwinners and women to be the caregivers. The blame placed on Mrs Reddy for not having a child despite external factors such as lifestyle or distance in the relationship and lack of physical intimacy with her husband reflects societal expectations and pressures placed on women to fulfil the role of motherhood. Mrs. Reddy is uncertain about the lack of an intimate relationship with her

husband, questioning whether it is due to her weight gain or the long periods of living apart. The decision to undergo IVF is influenced by the narrator's concern for their parents' feelings and the desire for companionship, indicating the complex factors in their reproductive choices. The statement on using donor sperm further emphasises the use of donor sperm to address the husband's inability to produce a child. This choice highlights the complexities and challenges individuals may face when trying to conceive and the importance of exploring alternative reproductive options.

To the question of donor preferences, she said,

Here, doctors told us that we should not ask about the caste background of the donor. But it is a matter of child. Honestly, I do not have a problem with any caste. I want it from the Hindu religion. But my parents are particular about caste. But that is not easy to find.

Mrs. Reddy's religion and her parents' caste-specific donor choice indicate an intersection of technology with the cultural values and identity of IVF users.

Seema (pseudonym), aged 29, a homemaker, consanguineous marriage, Hindu, OBC, lives in Kurnool in a joint family of five members. She travels by public transport to Hyderabad for her treatment. Sometimes, she stays at her cousin's place in the city. Regarding her IVF choice, she said,

I have given birth to my first child through IVF. My in-laws and husband have sent me again to have a second child. I was only 21 years old when I did IVF for the first time. I also wanted to have a baby because of social pressure. When I did not get pregnant two years after my marriage, they (in-laws) started questioning me. They think I am a machine that can manufacture a baby (said while holding a lot of resentment). My husband is my cross-cousin. He has never engaged in a physical relationship with me. Even with the slightest accidental touch, he gets angry and mistreats me. He has never accepted me as his wife in our bedroom. He goes and sleeps in his mother's room. My in-laws know this. My husband's friends doubted my character when I gave birth to my daughter. I cannot say anything more. I hope you understand. I do not doubt it, but I am sure he is not a man. But I cannot speak about this as this is a matter of family honour. Knowing everything, my family expected me to give birth. I cannot even think about that period. They found everything about IVF. I was neither ready for IVF at that time nor now. And they have again sent me to produce another baby for them. Now, I have frozen embryos left from the previous IVF cycle. This time, they want me to have a boy for them. I have no choice but to do this as I am financially not independent.

About donor treatment, she said,

I have no idea which sperm is used to make my baby because I was so naïve when I did IVF for the first time. But I know that she is my child. I have given my eggs, and I have given birth to her.

Like other narratives discussed under this theme, Seema's husband is the primary breadwinner, and she is a homemaker and caregiver. Like other women, Seema's economic dependency reflects the traditional gender roles of men and women. She has experienced extreme pressure to conceive despite her husband having no physical relationship with her. The lack of acceptance and intimacy within the marital relationship and the verbal abuse of Seema's husband upon an accidental physical touch reinforce the power dynamics, with the husband exerting control and the woman feeling powerless and vulnerable. Her in-laws are aware of her situation, yet they prioritise the goal of having a grandchild over addressing the underlying issues within the marriage. This pressure and expectations from her family and in-laws leave Seema with limited options and a lack of agency. Her financial dependency on her husband and lack of social support from her natal family further restricts her choices. The mention of frozen embryos and her husband and in-laws' pressure to start a fresh IVF with a gender preference reduced her to an object to fulfil specific societal expectations.

Seema's husband's friend criticising her and doubting her character upon giving birth to a child indicate that IVF and donor is still not a socially accepted infertility treatment option for many as a child is always expected to be linked biologically to their parents. Besides, people use IVF secretly due to the social stigma attached to IVF and donor options. Her uncertainty about the origin of the sperm used in the IVF process to conceive her child reflects a power imbalance, as doctors and her family did not inform her about her husband's sexuality. She was naïve during her first IVF treatment, possibly indicating a lack of agency. Her lack of access to information about the procedure and choices involved in assisted conception raises questions about the transparency and ethics surrounding assisted reproductive technologies. Lack of informed consent in IVF practice raises concerns about the potential implications and the consequences of using donor sperm without the knowledge of women who are undergoing IVF treatment.

Afiya (pseudonym), aged 30, is a homemaker. She stays with her family in the old city of Charminar, Hyderabad. Before starting IVF treatment, she hardly stepped out of her house for anything. Now, she uses public transport to visit the IVF centre almost daily for treatment. She has been married for eight years. Her inability to conceive is due to irregular or lack of physical relationship with her husband, as her husband stays in the Gulf for a living. According to her, she never continuously lived with her husband for more than a week in the last eight years of their marriage. Afiya feels uncomfortable speaking to her husband about the importance of a

physical relationship. Her husband has recently come to Hyderabad to start their family. Although the doctor advised them to try to conceive naturally, she started IVF upon her husband and mother-in-law's pressure. Afiya thinks having a child matter much more to fit herself into her social group than considering a physical relationship for a child with her husband now. Even though she is medically fit to conceive naturally, she still feels guilty for not having a child after eight years of marriage. She said,

My mother-in-law found out about IVF treatment. She supports me. She also comes with me to the hospital. Since my husband is a medical representative, he knows about IVF and discovered the city's best doctor and IVF centre. My mother-in-law is progressive. But she was reasoning that couples should conceive within one or two years of marriage, while for us, it has already been eight years without any such result. However, she does not misbehave with me or say anything wrong. Instead, she supports me and understands my emotions and pain. It has already been eight years. I do not understand this treatment (she narrates feeling guilty); I do not understand the medical language the doctor speaks, that too in English. That is the reason it is my husband who always speaks to the doctor, not me. To her inability to interact with doctors and her role in decision-making, Afiya said,

I know that it is an infertility treatment. I know this treatment is going to help me in having a baby. My husband desires that we conceive. All I want is to be a mother. It has been so many years since our marriage. Couples generally conceive within the first few years of their marriage. But I never stayed with my husband. Now, it is awkward to try for natural pregnancy. That is why I am still single. I am single because I do not have a kid to call me Ammi. My husband said IVF is the most advanced treatment and has more success chance. I do not know anything. My husband decides everything. Even if doctors suggest donor treatment, I am ready to accept if my husband agrees.

As discussed in the above narrative, under this theme, Afiya is a homemaker who financially depends on her husband and who is unaware of medical treatment options for conception. Her mother-in-law supports IVF treatment as she knows that Afiya and her husband stay apart. Afiya's mother-in-law expects her son (Afiya's husband) to earn money for the family. At the same time, she expects Afiya to conceive quickly and give birth to their family descendants. Pressure on Afiya to have a kid indicates the influence of gender role expectations. Afiya's reliance on her husband and mother-in-law for decision-making and support indicates a potential power dynamic where the husband's desires and knowledge about IVF precede her understanding and preferences. Afiya's limited understanding of the medical language and reliance on her husband to communicate with the doctor suggests a power imbalance in the decision-making process. The respondent desires to become a mother but acknowledges the

challenges of natural conception due to her distant relationship with her husband. Afiya accepted IVF and agreed to take donor treatment if her husband pointed to a potential subordination of her reproductive autonomy to her husband's decisions and a lack of awareness about one's own body and reproduction system.

Anandi (pseudonym) is a 28-year-old from the Hindu upper caste and has been married for five years, another respondent with whom the researcher interacted extensively. Anandi married her cross-cousin. She hails from Visakhapatnam and lives there with her husband. She is a B.Tech. Graduate. She quit her job after marriage as her husband did not like her to pursue a career. Anandi's family expected her to give birth soon after her marriage. Failure to meet that time-bound expectation has brought her suffering in many forms in her social setting. She had lived a life of guilt until she learned about IVF treatment. She considered her unfit to be in the marriage as she had believed herself to be the reason for not being able to conceive in all these years. Her first IVF treatment failed, and everyone in her family thought she was having the problem of what is called a 'biological lack.' Then, her husband agreed to go for the test upon her insistence, as her medical reports were normal. Then, it was found that the sperm quality of her husband was not in good condition. Although she is continuing IVF for the second time with donor sperm, her resentment towards her husband and her in-law's family indicates her constrained choice due to social pressure. She cannot break the marriage as she fears it might affect her identity in her society. In her words:

All these years, I blamed myself for being unable to conceive. I was thinking that I was defective. I mean, this is how my husband and in-laws felt about me. I have endured this stigma. My husband did not even come for any tests during the first IVF cycle. He and his family thought I had a problem because I am a woman. As a man, he cannot have any issues. I found that he is defective and cannot give his sperm. I will see who will trouble me anymore. I will silence everyone's voice (said with resentment).

During the second interview, it was revealed by the respondent that she had started IVF with donor sperm as her choice. She said,

I know my family has tortured me a lot. But you know it is also not possible to get a divorce and remarry in our society. It does not matter who has the problem. It is women who must give birth. I am using donor sperm now. The child is not going to be my husband's blood. I am not doing it alone. My husband has signed the consent form. He will be the father as well. He is ashamed of his biological problem and all the misbehaving he and his family did to me in the past. But now he wants to keep his problem a secret. It was also not easy for him to accept the truth initially. Slowly, he accepted. Since I am doing the treatment for his sake, they can also not torture me. I know they are

very particular about family honour. So, they will never want this fact to be public, and I will have the key to silence them. At least they cannot blame me for this now. So, I am relaxed.

Chaitanya (pseudonym), age 29, OBC, Hindu, had an arranged marriage in Kurnool town five years ago. She is a homemaker and studied till the twelfth standard. Chaitanya lives within a joint family of eight members. She tolerated the brunt of infertility and the stigma attached to it for years until her husband was diagnosed with a low sperm motility problem. She was almost isolated from her family by her relatives. She was discouraged from participating in many social ceremonies. As a result, she underwent depression for a long. She was not aware of IVF and male factor infertility or sub-fertility. Her husband was diagnosed with male-factor infertility when they tried IVF. Over-emphasis on women's fertility and ignoring of male infertility points to the prevalence of the age-old patriarchal stereotype that places women under a critical lens for infertility, absolving or acquitting men for their 'biological lack.' She feels angry with her husband and his family because she thinks she has suffered a lot. She said,

I know my husband is not a wrong person, but all these years, he was silent. He also did not leave a chance to comment on me. I could not attend family functions, including marriages, seemanthams (baby shower), etc. My in-laws and relatives criticised me for not being able to conceive. Because of these mental sufferings, I underwent depression for a long. Now I found that my husband has the problem. He is going through some surgery. He will realise the pain now, both physical and mental (said with resentment). Initially, I did not feel like doing IVF further when he was diagnosed with a male factor problem. But my family made me understand that I should control my anger and resentment for the sake of my better future. If I seek a divorce, society will not let me live peacefully. I already know what social isolation means. So, I must pursue IVF. But I know they cannot torture me anymore as they know it is his problem. If they try to do that, I will tell people that he has some defect, not me.

Anandi and Chaitanya have expressed a similar perspective regarding their reproductive decision, which is a limitation. Despite facing domestic verbal abuse, they opt to stay in their marriage due to societal pressure against conceiving, illustrating the dominance of social structural power over individual agency. Their willingness to use donor sperm demonstrates their susceptibility to societal expectations and social pressure. While their acceptance of IVF and donor treatment indicates a restricted choice, it allows them to exert some influence in negotiating with their in-laws to protect family honour. This negotiation signifies a degree of agency that may not empower them fully but enables them to secure a safe position within their family.

Men's biological lack: Women exercising moral agency

The social stigma attached to the inability to give birth feels like a deviation from masculinity and femininity norms, which is considered a “hidden disability” or “a curse of god” (Miall et al., 1986; Sandelowski, 1988, 1990c). Treatment for male infertility through in-vitro fertilisation (IVF), particularly of ICSI and donor insemination, if required, offers a potential solution for fertile women whose partners are infertile and who are willing to accept these facilities, which allows them the opportunity to undergo pregnancy, childbirth, and experience the joys of parenthood. Women might be physiologically fit, but to pursue fertilisation of their eggs with either their partner's sperm or donor sperm, they must endure a series of procedures such as hormonal stimulation, intravaginal or intra-abdominal treatments, under general anaesthesia, and undergo sonography and other painful processes.

As previously discussed, even in male infertility cases, the responsibility of giving birth within a marital relationship typically falls on women. In this context, we are exploring how women opt for IVF treatment in cases of male infertility and are open to donor insemination if necessary. However, it would be inadequate to claim that women's choices are unconstrained, as societal pressure weighs heavily, even when their male partners are medically determined to be infertile. This theme diverges from the previous theme, where the researcher examined how women select IVF treatment under constrained circumstances.

Within this theme, the researcher delves into how women choose to undergo the physical pain associated with IVF treatment and willingly accept donor sperm when required, guided by their moral reasoning. This choice of women is not only ‘natural,’ which is often socially constructed, but also ‘morally necessary’ (Throsby, 2004, p. 4). By choosing IVF and donor insemination (where needed), women in this context perform the role of ‘moral pioneer’ (Rapp, 1988). It is argued in this section that these women are ‘moral pioneers’ because they defy societal expectations and forge new paths in reproductive decision-making for their husbands and themselves due to moral reasons. Women often repeat in their narrative that they are fundamentally fulfilling their moral responsibilities.

Nidhi, aged 29, is an upper-caste Hindu respondent. She lives in Guntur, Andhra Pradesh, with her family as homemakers. Nidhi lives in a rented house in the city near the IVF centre only for her IVF treatment. She has been pregnant for nine months. Regarding her IVF, she said,

My eggs are healthy. We cannot go for IUI as my husband requires intracytoplasmic sperm injection (ICSI). That is why I choose IVF, a more advanced technology. When I

was having a problem, my husband supported me. Now, it is my turn to support him. My in-laws are not good. They do not support me. They blame me for not giving birth all this year. But they do not know that my husband's sperm is infertile. And we did not tell them about it and IVF. It is our problem; we will sort out this matter together. Since I had no biological problems, I had no difficulty conceiving. But family is important. I am even ready to accept donor insemination if required. I have discussed that with my husband. He agreed to it, and I also do not have a problem. I am hoping to see my complete family soon with a child.

Amisha (pseudonym) is a twenty-nine-year-old resident of the US, and her husband is a software engineer. Her native place is Visakhapatnam, Andhra Pradesh. Her husband was diagnosed with male-factor infertility issues when they consulted a doctor two years after their marriage. She and her husband decided to go for IVF treatment. She was young and only twenty-four years old when she did her first IVF. She had her first child, born through IVF. She chooses IVF despite she is not having any physiological problems. Regarding IVF choice, she said,

It was not easy to do IVF the first time. I was young, and I had lots of mood swings. I did IVF because of my husband. I share a very good bond. He greatly supported me in our relationship, so I had to cooperate with him. This is the second time I am doing IVF. And I am aware of the challenges this treatment can bring to a person mentally. We at least have this option, and I thank God for it. Otherwise, what is the meaning of life? I can understand what my husband might have gone through mentally when he came to know that he lacked something to contribute to my pregnancy. But we had to hide that from others and still maintain our privacy. But no matter who has the lack, it is because of the availability of technology that I have become a mother and am now trying for my second child. After all, extending our family tree is my responsibility and moral duty.

Swapna (pseudonym), age 35, a B. Tech graduate, lives as a homemaker. She belongs to OBC, the Hindu religion. She lives in Guntur with her joint family. Temporarily, she lives in Hyderabad city for IVF treatment. Her husband has lower sperm motility. Because of this, she has no other option left than going for IVF. Concerning her IVF choice, she said,

My in-laws and husband asked me to stop taking any medication. They are worried about my health. My family told me I should not have any health problems because of these medications. I said to them that let me try for my last chance. If it works, fine; otherwise, I will stop here. They are worried that this treatment will affect me in the long run. But I am concerned about my family. I feel my moral responsibility is to give them a child, a grandchild (with a smile on her face). They love me so much. They will be happy if I give birth to a child, but they said not at the cost of my health. At least they are saying this now. I do not know how they will react and behave later (with a smile again). We needed intracytoplasmic sperm injection (ICSI). My husband feels guilty about his low sperm

motility. I do not want him to feel that way. More than his problem, he is worried about my health. My family is doing so much for me then; how will I not make a little sacrifice for them? And I am not doing this only because of them. I also want to be a mother.

Ridhima (pseudonym) is 29 years old and belongs to the upper-caste Hindu religion. Her natal family is in Srikakulam, Andhra Pradesh. She lives in Hyderabad with her husband, who works as a priest in a temple. Regarding her IVF choice, she said,

I have not studied much. I have studied only up to the 10th standard. I got married early, at the age of 22, and I am a housewife. All my friends and relatives have got a baby very early. Unfortunately, I am the only person who does not have a child. I have stopped attending family functions and gatherings because I do not have answers to my friends' and relatives' questions. I belong to a big joint family of my in-laws. So, it is not easy to survive without a child. Even if it is my husband who has the problem, it is I who cannot be the mother. So, we had to choose IVF. People question me, not my husband! And how will I tell them it is my husband's problem, not my mistake? After all, it is about family honour. Even my in-laws do not know about it. We both live in Hyderabad. He is a lovely person. He also wants to become a father. We both want to be parents. But he cannot share his pain. So, it is my moral responsibility to do anything for a child. Suppose it is through IVF, then fine. I accept it. You know, it is a little tricky and painful procedure, but I do not have any other option than doing IVF.

In all four narratives discussed above, women expressed a great sense of support they received either from their husbands or their in-law's family in their marital relationships. Despite experiencing a subtle form of social constraint, these women choose IVF to fulfil their moral responsibility towards their family, who has long supported them. Their ownership of the responsibility of the so-called infertility treatment shows their ability as 'moral pioneers' who defy the privileging moral norms of giving birth naturally. By exercising this moral agency, women conform to the long-existing gender role where society expects a man to make a living and a woman to be the caregiver, particularly in the process of giving birth to a family descendent.

Section-II

Reframing IVF: Exploring the inner journey of women as a spatial experience

This theme underlies an alternative approach to understanding the experience of women undergoing in vitro fertilization from a sociological lens. Here, the researcher examines IVF as a medical procedure and a socio-technical phenomenon embedded within the broader social, cultural, and technological context. By framing the inner journey of women in IVF as a spatial

experience, an attempt is made to highlight the intricate connections between physical spaces, technological interventions, and the lived experiences of individuals with IVF treatment. Using a socio-technical analysis approach, this section explores the spatial arrangements, such as clinical settings, laboratories, and home environments, and how they influence and shape the experiences, emotions, and identities of women undergoing IVF. It further underscores the importance of considering the socio-cultural dimensions of fertility treatments and the role of technology in shaping reproductive experiences.

After women choose to do IVF, they enter the reproductive arena, which is filled with uncertainty, hope, risk, and possibilities. This experience is a short period for a few who get successfully pregnant through IVF and give birth in their initial attempt. It is a long journey for many without immediate results from technological assistance. Women of either category experience uncertainty, hope, risk, and possibilities with a greater or smaller degree of variance based on their situated experiences. This section of the chapter discusses women's subjective experience of pain, risk, hope, and possibilities in their IVF journey in the temporary space of a fertility centre. It is a journey that is unique to each woman undergoing IVF treatment. To begin with, the section starts with narratives of women who are in their early period of IVF treatment and who have surpassed the journey in one or two IVF cycles. In the second part of this section, we shall bring a more nuanced notion of the motherhood journey in IVF treatment that involves a lingering journey of pain and risk defined with hope and possibilities by prospective mothers.

Normalizing pain: Embodying motherhood through assisted reproductive technology

Women in the IVF process often associate themselves with pain, i.e., bodily pain, which she alone experiences throughout IVF treatment. Feminist scholars like Gene Corea studied the experience of women undergoing IVF and depicted pain as a pattern of exploitation (Corea, 1986). For Corea, IVF treatment is nothing but the harm done to women by patriarchy, which devalues women and their bodies (ibid). Unlike this feminist approach, scholars like Sawicki (1991) argue that women's desire to become mothers through IVF is shaped institutionally (Sawicki, 1991). This institutional shaping of women's choices falls under the social context of having strong medical discourse.

The institutional approach and feminist perspective of women's experience study women as non-agentic passive recipients of technology and lacking agency. Riessman (2002) studies South Indian women's identity concerning infertility and argues that women are not victims of

medical technologies but are active agents who negotiate infertility (Riessman, 2002). Conventionally, in the study of body perception, its action was seen as originating from an external source, leading to a disregard for the subjective experience of pain when considering the female body (Scarry, 1985; Williams, 2006) introduces an embodied approach to examining the body, particularly in health and illness. This perspective challenges separating the body and mind, rejecting Cartesian dualism. Instead, it highlights the dynamic nature of the body, viewing it as an active and conscious entity that continuously engages in meaningful experiences. According to Williams (2006), “this perspective lays the Cartesian ghost, mind–body dualism to rest once and for all, and in contrast emphasizes the moving, thinking, feeling, pulsing, body; the lived body as a mindful, intentional site of ongoing experience” (Williams et al., 2006, p. 10).

Women interviewed for this study expressed a deep desire to become a mother. This embodied desire dominates the pain they experience in their motherhood journey. Women in their journey of motherhood often prioritize their deep-seated desire for a child, even in the face of the pain they may experience. They intertwine their emotions with this pain and perceive it as normal. They construct their understanding and significance of their bodies based on their reasoning and rationality, which may differ from the rationality commonly discussed by Western feminist scholars. In ‘IVF: An Irrational Choice,’ Koch argues that women who undergo IVF treatment have a unique and self-defined form of rationality (Koch, 1990). Women in the IVF journey follow their norms and belong to the ‘other world’ (ibid). Women create this ‘other world’ by assigning meaning to their experiences.

Reema (pseudonym), age 32, Christian, an MBA graduate, is a willing homemaker. She lives in Muscat, Oman, with her husband. Her native is in Warangal, Telangana. Temporarily, she is staying in Hyderabad for infertility treatment. She is undergoing IVF for unexplained medical reasons. She shares a mixed experience with IVF technology, from starting the treatment to becoming pregnant for seven months in her first IVF cycle. Regarding her experience with IVF procedure, she said,

I cannot say that doing IVF is easy. But I have learned to accept it; to accept all the exhausting processes, waiting time in the hospital, and pain coming from every step of IVF, starting from taking injections to egg retrieval, doing all scans, transferring embryos, etc. But I choose to do it. So, I had to tolerate all the pain. Before starting the procedure, I did not know it would be so tiring. But I am happy that I am finally pregnant now. Staying alone here in Hyderabad and doing everything alone without my husband was more painful for me mentally. There was a time when I used to get mentally

exhausted when I was thinking about IVF procedures and the possible pain associated with IVF. And I endured all the pain. But finally, I choose to do IVF because nothing we gain without pain. Now, it feels like a normal pregnancy. Technological intervention and rigorous treatment are painful, but this pain is temporary. We, women, are natural pain bearers. Every woman goes through this phase of life. Having a child is important, which is above and beyond the pain I have experienced for a certain period. After I conceived, everything looked normal.

This narrative brings out an embodied perspective where Reema normalizes and rationalizes the pain, which is necessary for her to achieve motherhood. However, women in this context do not reduce their rationality to individualistic ideas of self. Instead, they are embedded with the meaning women derive from their socio-cultural values. In other words, women's physical bodies and experiences act in a socio-cultural context (Young, 2005). Women live not only with their physical bodies. They live in a society that has its own cultural norms. These norms often shape how its members think, feel, and exhaust meaning about their (using her because we are discussing women here) bodies and bodily experiences. Sapna (pseudonym), age 32, who is doing IVF first round, said,

Kastam lenide phalitam dakkadu (no pain, no gain). Baby kosam edaina (anything for baby). Na chetilo bidda puttina tarvaata ee baadhanu evaru gurtunchukuntaaru (who will remember this pain after I have a baby in my hands). And isn't it natural for women to bear pain? We need to give birth, right? My mother, my grandmother, and her mother have endured pain so that we could see the light of day. I am not isolated from the society. So, I am doing it now. Who does not like to conceive naturally? Unfortunately, due to some reason, I could not conceive naturally through intercourse, so I had to choose this treatment. Just that IVF adds little more to the pain other women in my family have endured. But it is okay to bear that for the sake of the baby.

After a gap of six months, when she was interviewed for the second time, she was pregnant for five months, and that was the last scan she was doing in that fertility centre. She is planning to go back to her native place, Visakhapatnam, in a few days and is planning to deliver her child there. She says,

My family is very happy that I am finally pregnant. I am carrying my child now. This is what I wanted. God has blessed me generously—many thanks to IVF and the doctor here (the IVF specialist). I know I will forget all the suffering once I deliver my baby.

Through her narrative, Sapna expresses a dominant social understanding of women's normalization of pain and endurance in achieving motherhood. For women like Sapna, establishing her identity through motherhood and meeting social expectations is essential.

Cultural norms inherently shape Sapna's relationship with reproduction and with her body. Cultures assign specific meanings to these physiological distinctions. In particular, the female body, commonly associated with reproduction and motherhood identity, often involves physical changes that affect a lot of pain. Though Sapna wishes to fulfil social expectations, she embeds her reproductive choice with her desire to achieve a motherhood identity. The process of attaining motherhood identity involves cutting and scarring the body. Women like Sapna and Soma normalized pain in their IVF journey. Soma (pseudonym), Age 29, married for eight years, from a Hindu, upper caste family, works in an MNC in Hyderabad, India. She has had one IVF cycle failure and was doing her second round of IVF at the time of the interview (the first time). She said,

I know we have some medical problems due to which we fail to have a child. I accept that problem. At the same time, becoming a mother is very important to me. I know my husband loves me very much. He does not want me to undergo such technological intervention and bear all the pain. He has proposed for adoption as well. I do not have a problem with adopting a child. If I adopt a child also, I will love the child very much. But my husband will never understand what it means for a woman to experience pregnancy. I want to experience the joy of carrying my baby. Even if I have to use the donor's egg and sperm, I want to carry the baby because I will be more attached to the baby. This experience will be different if I adopt a baby. 'Pain makes a woman more attached to her baby' (said in an emotional voice). Experiencing pain during pregnancy has its own importance, which we will miss if we adopt a baby. IVF is helping me to experience motherhood. I want to take and bear all the pain for a child. It is painful physically, but it gives mental satisfaction. I choose to experience this pain.

Soma continued to speak.

The doctor told us that the details would be completely anonymous. But as aspiring parents, we also have every right to know at least the skin colour and if the donor has any genetic disorder. Most importantly, the donor must be Hindu and north Indian, as we are originally from Rajasthan. Otherwise, people will question the identity of the child. The doctor told us that donor details would be completely anonymous. But as aspiring parents, we also have every right to know at least the skin colour and if the donor has any genetic disorder. Most importantly, the donor must be Hindu and north Indian, as we are originally from Rajasthan. Otherwise, people will question the identity of the child. Convert into a narrative.

Later, she gave birth to twin daughters without using donor treatment. With a satisfied smile, she said,

See, mehnat rang layi (hard work paid off). Today, I am blessed with two beautiful angels. I am so grateful for advanced ARTs like IVF. It did a miracle. And both of our daughters look exactly like me (said with a sense of satisfaction).

Soma expresses a strong desire to experience the physical process of carrying a child in her womb, emphasizing the importance of the embodied experience of pregnancy. This desire comes from the belief that this bodily connection will create a stronger bond between herself and her child. The pregnancy experience is integral to the journey to becoming a mother, shaping her identity and relationship with the child. Her expression of deep emotional attachment to the idea of having a child and her desire to have a biological connection with the child is portrayed as a means to strengthen the mother-child bond. Her normalization of pain implies that the latter is integral to the journey to becoming a mother. Her normalization of pain as a sense of achievement reflects a cultural norm that values the endurance of pain as a means to achieve desired outcomes. Another woman, Rekha (pseudonym), age 30, doing her second round of IVF, said,

See, I want to be a mother. All my relatives and friends have already given birth to their children. I think I am the only one in my circle still 'single.' I believe each women's IVF experience is different, and of course, as women, our experience will always be different from men. No man can indeed understand the pain we endure during IVF treatment caused by hormonal imbalance. This treatment process is not that painful for me because I know this is a temporary period. I will be all right after I give birth. I feel relaxed because my husband is very supportive and cares for me. But I have seen women suffering a lot due to lack of support. This treatment needs a lot of patience, and social support is necessary.

During the second round of interviews, Rekha said,

I was initially facing mood swings and other hormonal change-related problems because of my twenty-day injections. That time, I thought this was the end of the pain. But later, I realized this treatment was more than I expected. It is very painful. But like I said, I get very good support from my husband. So, I easily overcame this stage and am now successfully pregnant for six months.

Swapna (pseudonym), age 35, has been married for 11 years. She is experiencing some medical problems in her uterus, because of which she is having multiple miscarriages. She continues the treatment while enduring pain with the hope that IVF technology provides to many. In her words,

I have many side effects because of the injections and medication, like acidity, putting on weight, mood swings, hair fall, etc. Apart from that, egg retrieval and transfer are a very

painful process. But it is okay. Baby janmanichina tarvata nenu anni pains marachipotaaanu (Once the baby is born, I will forget all the pain).

Both Rekha and Swapna emphasize the embodied experience of undergoing IVF treatment. Rekha recognizes that IVF experiences vary among women and believes that women's experiences will always differ from men. Swapna mentions the physical and emotional side effects she is experiencing, such as hormonal changes, weight gain, mood swings, and pain. At the same time, both expressed a strong desire to become mothers. Rekha desires to become a mother, as all her relatives and friends have already given birth. Swapna has been married for eleven years and is enduring multiple miscarriages. Both persist with IVF despite pain and challenges because they believe in IVF technology and are hopeful of achieving their dream of motherhood. Both illustrate different perspectives on pain normalization. Rekha initially believes that the IVF treatment process is not that painful for her because she sees it as a temporary period that will lead to her desired outcome of giving birth. She also mentions the importance of social support in helping her cope with the pain. On the other hand, Swapna acknowledges the pain and the various side effects she experiences but remains committed to the IVF treatment, believing that such pain will be worth it once she becomes pregnant and after the baby is born.

As stated, narratives depict women's normalization of pain as subject to vary according to the social and economic support they have. Pain is temporary, as they experience it in their spatial engagement with IVF technology. When they fail to conceive naturally, it creates an emptiness in their life and distances them from the experience of motherhood. IVF technology, they believe, has helped them to experience the desired motherhood, which they think is a helping hand to nature. Many endure pain as this technology promises them some certainty that creates hope in them.

Dilemma and everyday challenge in IVF: Embracing uncertainty with hope

In this section, the everyday hardships experienced by women in the IVF journey are explored. Hardships women experience is integrated with ethical moral dilemmas derived from notions of patriarchy and gendered social structure. Women embarking on the IVF journey encounter various challenges, including emotional turbulences, health considerations, financial burdens, and career-related obstacles. Notably, the narratives shared by women who have undergone multiple unsuccessful IVF cycles highlight a compelling moral dilemma. They face profound

contemplation regarding decisions on the continuation of the treatment at different stages, ultimately impacting their path forward. Their moral dilemma engenders a delicate balance between hope and an uncertain future mediated through the gendered social structure. Despite women's obstacles, in vitro fertilization (IVF) has continued to be regarded as a 'technology of hope' (Franklin, S. 2022). Its perceived advantages are minimizing risks and uncertainties associated with desired therapeutic results (Webster, 2002).

The socio-cultural context surrounding the IVF procedure is discussed in this section to understand the significance of uncertainties, hope, and moral dilemmas that arise at different stages of IVF involving decision-making. The function and implications of these reproductive technologies are continuously reinterpreted and renegotiated in everyday life by the women interviewed. A woman named Roma (pseudonym), 32 years, said,

I live with the fear of not knowing what will happen to my body in the future due to the medications I'm currently taking. Who honestly cares about my health? (tears well up). Each time I embark on an IVF journey, I understand I'm entering a new realm of risk. The truth is, I have no other choice. I know I must take these risks. Everyone talks about IVF, and people may listen to my story like any other. But no one can truly share the pain I endure every day. I told my husband, "While you may provide the financial support for the treatment, you cannot truly understand my pain." However, he claims to comprehend my pain and cares about me. That is why he will not let me quit this treatment (she hides her painful emotions beneath her words). How can he possibly understand the daily torment I experience? I feel stressed and unhealthy, unsure of the diseases that may afflict me in the future, as no one knows. It is a deeply agonizing reality. I am certain that I will develop severe health issues down the line. I am already experiencing intense back pain. My husband supports me financially but cannot fully grasp the depths of my suffering. Official websites of IVF centres boast a success rate of sixty to seventy per cent for IVF treatment, but once you are in the midst of the treatment, the doctor advises you not to dwell on the outcome. It is a point of no return. There is no stepping back once you begin. It will help if you are ready to take risks, holding onto hope for a positive outcome. Despite all the challenges, I will continue the treatment until my doctor and my body allow it. Despite the uncertainties, having a child is immensely important to me.

She grapples with the moral dilemmas of her choices and the personal sacrifices she makes for the chance at motherhood while simultaneously facing the daily physical and emotional hurdles that come with the treatment. Amid all the uncertainties and challenges, IVF still is a hope for her, which acts as a guiding light to escape from this pain and endurance. Similar anguish and hope Mitha expressed. Mitha (pseudonym), age 30, Hyderabad, OC, who was working in the IT industry, said,

Coming to the hospital daily while taking off from the office is challenging. The waiting time is very long here. I travel a long distance daily: from home to office, office to hospital, and again from hospital to office and home. I have been experiencing many health issues since starting the IVF treatment, even after maintaining a healthy lifestyle. I have taken and am still taking a huge number of hormonal injections, which is causing me so much hair fall and many pimples on my face. I have put on so much weight. After every IVF cycle, I exercise and lose weight. Again, in the next IVF cycle, I put on weight. I take a lot of progesterone hormone. Whenever the doctor gives those injections, it makes my breasts tender. I have taken lots of anaesthesia, right? I do not know If I am correct or not. I do not know if it is normal or happening only to me. But yes, I have observed that I have started losing my memory. It is like I say something or do something at a moment that I forget after some time. I have read somewhere that whenever people take anaesthesia for surgery, they lose memory. I shared this with my husband. He said I am overthinking. See, this is how he supports me. He is supporting me, but then he wants me to go through IVF repeatedly. He will not let me stop that. Recently, I quit my job. I was reaching the office late. I had to quit because I could not sail in two ships, right? But I am afraid my juniors go ahead, leaving me behind when I return to the job.

On top of this, IVF expenditure is high. Recently, I sold the only property my natal family gave me during the marriage. IVF is such a complex treatment it involves many procedures. If A does not work, they go for B, C, or D. Similarly, initial treatments like preimplantation genetic screening (PGS) (expand) and endometrial receptivity array (ERA) determine the use and usability of the IVF procedure. It depends on the patient. So, I am confused about what to do next. It is like we are spending all our earnings. My husband says it is okay to spend money now. Maybe we can earn more after we have a baby. But I feel insecure about selling the only property that I own. But I have made these sacrifices for a baby.

Mitha reflects on her daily challenges and insecurities while undergoing IVF treatment. She describes the difficulties of frequent hospital visits and the toll it takes on her work-life balance. The physical, emotional, and financial strains she endures underscore IVF's complex and multifaceted nature. The narrative highlights the sacrifices, uncertainties, and difficult decisions individuals like Mitha encounter as they navigate the complexities of fertility treatments. In the second interview, Smita further reiterated,

After enduring four failed IVF cycles, I feel a sense of emptiness. With each miscarriage, I experienced a profound loss, as if I was actively losing a part of my own body. When I asked my doctor about the cause of these failures, she told me that my body was not accepting the embryos. She explained that my body functioned as a foreign entity to the embryos and suggested that I keep trying, as my body might eventually accept them. So, we went through five cycles, and when we did not achieve the desired result, we were completely shocked. Just imagine the state of my mental well-being. It is difficult for me to comprehend this logic. It is my own eggs and my husband's sperm that I used to create

the embryos – they are our potential children. However, the doctor refers to them as foreign bodies, separate from mine. It feels contradictory. Before starting the procedure, the doctor gave us a guarantee of a seventy to eighty per cent success rate, as they did not see any significant problems in me. If I had successfully conceived and given birth, they would not have considered my child as a foreign body. But when I fail to conceive or experience a miscarriage, suddenly, they categorize the embryos as something not part of my body. In another instance, the doctor once told us that they had done their best and that the outcome was beyond their control. They explained a theory to us, comparing embryos to seeds. They said that we can only implant embryos, just like a seed. The seed will only germinate if it lands on fertile soil. If it does not germinate, it's not within our control.

After multiple cycles of IVF failures, Mitha is disappointed with the technology and the doctor who is offering IVF treatment. Her faith in IVF and doctors has shifted from hope to uncertainties. The cause of these failures is unclear, and the doctor's explanation that her body is not accepting the embryos introduces further uncertainty. Despite their genetic connection, Smita questioned the medical system as to why their body is suddenly seen as foreign to the embryos. The risk of miscarriage and repeated failures weigh heavily on Smita's mental well-being. The doctor's explanation of the seed and soil theory further emphasizes the notion of risk. Just like planting a seed, there is an element of unpredictability and factors beyond the doctor's control that may determine the outcome. The uncertainty introduces an element of risk in pursuing conception through IVF. This narrative explores how individuals negotiate and make decisions within a socio-technical context, where technology is weighed between promises, possibilities, and the inherent uncertainties and potential risks involved.

One year after the second interview, Smita gave birth to a baby through 'natural conception.' She is still unclear if her so-called natural pregnancy occurred due to multiple cycles of IVF procedure and the medication, she had taken during the IVF cycle, which she thinks might have worked later. This uncertainty raises questions about the interplay between the IVF technology, medications, and the subsequent natural pregnancy, blurring the boundaries between the two and leaving Smita unsure of the exact cause of her successful pregnancy.

Another respondent, Mehru (pseudonym), age 33, who had an inter-religion marriage, said,

I was running from one hospital to another, consulted many doctors, and then started IVF. No one informed me about my uterus problem. My uterus has been diagnosed to be having medical complications. But doctors were trying IVF on my body. I lost my health by going for IVF and also peace of mind. I have spent all my savings. I would say I have

brought all my present health issues through IVF. The only reason I endured all the pain was to have a child. But when IVF failed, the doctor said, 'What can we do amma? Your body is not responding to our treatment'. Later, doctors informed me that apart from my fallopian blockage, my uterus had some problems. My uterus cannot carry a child. I wonder why they did not tell me about this before.

I do not have money now to go for surrogacy. Had I been informed about my uterus that I could not carry a child even through IVF, I would not have gone through this many IVF cycles. When I go to the hospital complaining of pain, the doctor says, 'Itna sara problem ka ham kuch nehin kar payenge amma' (we cannot do anything to all your problems). Now, I have stopped IVF after four cycles. I have endured all these problems alone without even getting any support from my husband. I had hoped our marital life would improve if I got a baby through IVF. I do not know what is going to happen now.

The uncertainty of treatment outcomes and the unpredictability of IVF medications and procedures contribute to emotional distress and heightened anxiety. This narrative underscores the moral dilemma surrounding informed consent and transparency in IVF treatment. It highlights the inherent uncertainty accompanying the technology and the everyday challenges Mehru faces, encompassing physical, emotional, and financial loss. Though she is not raising any moral questions, this narrative questions IVF practice's ethical and moral dimensions. Her choice of quitting the treatment depicts a medical failure rather than an individual choice. Another respondent, Agasthi (pseudonym), age 34, upper caste Hindu, shared her experiences regarding IVF treatment and the challenges she faced during the treatment. She said,

My brother and sister-in-law supported me morally and took care of me during my last treatment. Now my brother has been transferred to another city. So, my husband is taking care of me. We have not informed my in-laws and other relatives about IVF treatment. Initially, it was easy for me to accept this treatment of IVF. I had the idea that test tube babies are not born naturally and that they are like robots. After many rounds of counselling, I started believing in this treatment, and now I feel that my child would be natural (said with doubtful emotion). But our society still thinks test tube babies are robotic, artificial, and unnatural.

My in-laws know that I am going through some treatment and conceived naturally. They will not understand. During my first IVF cycle back in 2013, I told them about IVF. But they spread fake news. And people started telling false news that my child would not be natural. It will not be my own child. It was not comforting at that time. Unfortunately, IVF failed then, and all my efforts proved fruitless. It was not easy to gather hope for IVF again. This time, I have started with a long gap, but I am worried that if my child (prospective child) gets bullied by his friends in school or playground! How will 'he' defend them? How will he say he is not an artificial child but as natural as others? So,

this time, I have not informed anyone. It is only between me and my husband. But it is challenging to do it all alone. Because my family members do not know about it, I hope doctors give me some positive news this time. I do not want to go for any more advanced treatment.

Agasthi is deeply concerned about the lack of anticipated support, the moral dilemma she faces regarding identity, and the uncertainty surrounding the potential child's future. Despite these challenges, she remains steadfast in pursuing conception through IVF technology. Her choice to continue with IVF treatment demonstrates her attempt to reconcile the moral dilemma and uncertain future she envisions with her strong desire to begin a family and embrace motherhood. Agasthi, who holds traditional values, believes that conceiving a baby naturally, without technological assistance, is natural and morally acceptable. However, she views IVF as unnatural and expresses concerns about her child's identity, comparing a test tube baby to a robot. Despite being caught in a moral dilemma regarding right and wrong, Agasthi persists in her conception journey through assisted reproductive technology. Agasthi's IVF choice, despite her moral dilemma, illustrates how the technology of hope and the uncertainties of moral dilemmas intersect and mutually influence each other.

Like Agasthi, Shree (pseudonym), another respondent, upholds traditional values and thinks that conceiving a baby naturally without relying on technological assistance is virtuous. Conversely, utilizing reproductive technologies is predominantly seen as unnatural and sinful. Shree is 30, an upper-caste Hindu graduate, and a homemaker. She says she has navigated the dichotomy between virtue and sin, ultimately dismissing the notion of sin in favour of the virtuous act of bringing a child into the world. She said,

I have long regretted for a while, realizing I could not conceive naturally. But how long should I regret it? Taking technological assistance for conception is taboo. This artificial way of conceiving a child is not acceptable in our society. My in-laws and family will never accept this. But not having a child is more sinful and painful. If accepting an artificial method to conceive is a sin, then not having a child is another stigma. Which value should I prioritize? Finally, I broke all restrictions and accepted IVF. Manchi mariyu chedu emiti? (what is good and bad?). Baby kosam paapam aina parvaaledu (it is okay to do an act of sin for a baby), Paapa kosam emainaa okay (anything for a baby). Yes, this treatment is painful, but it is nothing compared to being childless. I am attempting IVF for the third time. When I asked about my previous failure, doctors said, 'We do our job'; rest is upon your body. Humans cannot get everything we want, but we must keep trying. Nowhere does IVF work with hundred percent success rates.' Today, I am undergoing an endometrial receptivity array (ERA) test. See, after every IVF cycle

failure, they (doctors) introduce some new technology. They do not understand how difficult it is for me to undergo it alone.

Shree grapples with a moral dilemma when considering IVF. As a Hindu woman from an upper caste, her cultural or religious beliefs question the legitimacy or morality of assisted reproduction methods—Shree's IVF choice conflicts with societal norms and her desire to have a child. The moral dilemma exemplifies the ethical dimensions that emerge when technology intersects with deeply held values and beliefs. Shree's desire for a child is an embodied choice, meaning it is an essential part of her physical and emotional being. Apart from that, societal stigma burdens her, making her question how long she should feel regret or societal judgment about childlessness. Shree's decision to pursue IVF showcases her negotiation with the technologies available. She breaks societal restrictions and embraces the assisted reproduction method, demonstrating agency and a willingness to navigate the complexities of reproductive technologies. Shree's definition of childlessness highlights the immense emotional and psychological pain experienced by individuals who cannot have children. While the treatment may be physically painful, it pales compared to the emotional anguish and longing for parenthood that childless individuals often endure.

All the challenges, including health, finances, and compromise with moral values, are the 'risks' women choose during the IVF procedure. Among these, women who actively fail to conceive through IVF choose to stop IVF due to physiological or financial conditions and find themselves caught up on the edge of the IVF process. On this edge, uncertainty actively permeates their choice and decisions regarding the continuation of the treatment. Women discussed in the context of medical innovation find themselves at the intersection of technical and social processes. The technical provides them with hope and uncertainty; society either questions their virtuous, righteous act or gives them social stigma. Women are uniquely positioned as 'moral pioneers' who actively navigate the challenges of integrating technology and society (Rapp, R. 1988). The term 'moral pioneer' actively underscores how these women grapple with the ethical complexities that emerge when new medical technologies are introduced into social contexts. As a moral pioneer, embarking on the risk of undergoing IVF alone, without informing any family members, while compromising health and finances, was a disappointing endeavour with no desired outcome.

Disappointment with IVF technology and with the doctors, or what Barnes calls 'medics,' raises questions about women's status as moral pioneers. *"Medics are those with whom prospective women base their relationship on technological knowledge rather than based on trust. Moreover, the relationship between 'moral pioneer' and 'medic' starts to break down. As a result, women who embody the role of 'moral pioneer' perceive 'medics' as becoming the technologists of the body rather than healers"* (Barnes, 1999).

Discussion

The present chapter delved into the world of women seeking assisted conception through IVF technology. Women's (respondents') narratives presented under multiple thematic categories reflect their everyday experiences with IVF treatment procedures under various socio-economic and cultural contexts. The first part of the chapter delved into women's dilemma in making IVF an alternative to assist their pregnancy. In this part, the so-called 'biological lack' concept is important as women have expressed their reproductive agency through their bodily experiences. The word 'biological lack' is a form of deficiency that, according to women, needs to be cured through IVF. Women have often used this self-defined 'biological lack' in their narratives.

Under the first theme of this chapter, 'biological lack; negotiating autonomy with reproductive capability through technology,' a nuanced meaning of autonomy is brought out, highlighting how women often negotiate with IVF technology and other actors like social, medical, technology, and financial. Under this theme, it is argued that women's autonomy and reproductive choices are not determined alone by their individual earning capacity or job status. A woman's socio-economic status and broader societal context have influenced how medical and technological assistance offers options for reproductive decision-making. These choices reflect a woman's ability to negotiate within the gendered norms imposed by her family. Despite IVF technology's availability, natural pregnancy remains the first choice for these women.

The second theme of this chapter, 'Transforming Biological Deficiency: Empowering Identity and Self-Worth via Technological Advancements,' discusses women's negotiation with IVF technology in identity shaping. As discussed, women undergoing IVF prioritize their identity as mothers. Their decision to opt for IVF as an alternative method of conception varies based on factors such as their education level and social environment. Women who are highly educated and employed in urban areas, where technology is more accessible, tend to be more

knowledgeable about IVF and assisted conception. Thus, they do not perceive them as unnatural or alien means of conceiving.

Conversely, women living in rural areas with lower levels of awareness may be less familiar with IVF and, therefore, more likely to view it as an unconventional or unfamiliar approach. As a result, women with higher education and living in a city generally experienced fewer conflicts or moral doubts regarding using such methods. In contrast, women with less education encountered more internal conflicts or moral uncertainties when considering these alternative approaches to conception.

Narratives discussed under the third theme, 'gender power dynamic and technological choice in conception,' shed light on the power dynamics within marital relationships. In marital relationships, the husband assumes the role of the provider, significantly influencing decision-making and the agency of the women involved. Women, dependent on their husbands financially, do not express complaints about the separation caused by their long-distance relationship or lack of physical relationship between couples. Women's lack of agency in the household indicates that even with the assistance of reproductive technology, women still lack full agency and remain distanced from the centrality of conceiving in terms of reproduction. The agency of these women in this context is determined by the social support they receive, particularly in the absence of economic independence. Under the fourth theme, 'Male infertility: women exercising moral agency,' the social stigma surrounding infertility is discussed, particularly where the pressure on women to give birth and the inability to conceive is perceived as a hidden disability or curse. In cases of male infertility, women who opt for IVF treatment, including potentially using donor sperm, face a series of painful procedures and physical challenges, social pressures, and ethical dilemmas. Despite societal pressure, these women choose to undergo IVF and, if necessary, accept donor sperm guided by their moral reasoning. Their choices defy societal expectations and make them moral pioneers, forging new paths in reproductive decision-making for themselves and their partners.

The second part of the chapter discussed women's journey into conception within the IVF procedure, which either led to success or failure in conceiving. In the first theme of the second part of the chapter, 'Normalizing pain: embodying motherhood through assisted reproductive technology,' women's deep desire for motherhood is explored, which intersects with societal constructions of what it means to be a mother. It is argued in this section that women, as active agents, create their meanings and demonstrate agency through their bodies by using IVF as a technological solution to overcome childlessness. Rather than being passive objects or solely

focusing on the physical aspects of their bodies, women perceive themselves as active agents who shape their identities and exercise agency. This self-derived meaning and embodied agency is distinct from the traditional notion of separating mind and body. The agency women exert in their IVF journey is a self-reflective agency that arises from being objectified through biomedical interventions and assisted reproductive technologies. It is further argued in this section that this self-reflective and self-defined embodied experience is rooted in their socio-cultural values.

The last theme of the chapter, 'Moral dilemma and everyday challenge in IVF: Embracing uncertainty with hope,' discussed how women as 'moral pioneers' negotiate with moral values and social expectations around motherhood and with the uncertainties derived from IVF technology and medics. This theme argues that women's negotiation with moral values to achieve motherhood is not merely a rational decision but something (what are they mention specifics) deeply felt and experienced by women within their bodies. The embodiment of desire reveals the intimate and personal nature of reproductive choices and their significance for individuals. Women highlight in their narratives how societal norms and expectations create moral dilemmas that can influence individual experiences and decisions regarding reproductive technologies. Women's negotiation with societal restrictions and assisted reproduction methods reflects the dynamic relationship between individuals and technologies as they strive to align their desires and values with the possibilities offered by scientific advancements despite physical, emotional, financial, and moral challenges associated with treatments like IVF. Women's negotiation ability with technology and society highlights the complex relationship between technology and desire, as individuals weigh the potential benefits against the physical and emotional tolls. The negotiation between women and doctors regarding the failure of the IVF procedure demonstrates how science, technology, and human desires intertwine within a realm characterized by 'uncertainty.'

Drawing from all these themes, it may be argued that IVF technology does not operate similarly for women of all categories. Women's socio-economic status determines how this technology operates for them. Despite further advancement within the IVF procedure, life creation outside the human body remains complex. The profit-making interest of capitalists, the embodied desire of women, the socio-economic status of women, and the social expectations determine the use of IVF. However, drawing the gendered nature of IVF technology may not be sufficient without studying the same from a male perspective. Therefore, in the next chapter, an attempt is made to illustrate IVF technology's 'translation' process in the social world of men.

CHAPTER FIVE

MEN, MASCULINITY, AND REPRODUCTION: LIVED EXPERIENCES WITH IVF TECHNOLOGY

Men's reproductive role is frequently perceived as secondary or considered the 'second sex' (De Beauvoir, 2007). This naturalistic view of gender-specific roles in reproduction has led to the distancing of men from the reproductive process in the popular understanding of their role. According to common notions, men's participation in reproduction is often limited to merely contributing sperm, while women are attributed to a more active role.

Generally, society defines distinct gender roles for men and women, relegating them to separate spheres. More than fifty per cent of infertility cases are attributed to male factors worldwide (Daar et al., 2002, p.17)). Only recently, the practice of male infertility treatment started with the advancement of assisted reproductive technologies like ICSI, MAC, etc. Scholars often overlooked the study of men's role in reproduction, instead focusing on women as natural child bearers and caregivers (Daniels, 2006). The reproductive area is predominantly studied by feminist scholars focusing on women's bodies, technology-related politics, patriarchy, and capitalism (Stanworth, 1987; Corea, 1986; Strathern, 1992). Omitting men from gender studies implies that their physicality, attitudes, and behaviour are considered inherently 'natural' and 'essential' (Gutmann, 2007).

Few scholars investigated men and masculinity in depth, exploring its connection with reproduction (Mohr & Almeling, 2020; Almeling & Waggoner, 2013). The primary objectives of these studies were to develop a comprehensive conceptual framework and achieve a deeper ontological and epistemological understanding of this complex relationship. Few studies explore the correlation between masculinity and reproduction from an ethnographic lens in the context of assisted reproductive technologies (Inhorn, 2009, 2006). Inhorn and Wentzell (2011) delved into examining men's negotiation of alternative and hegemonic masculinity within the context of introducing advanced reproductive technologies in the Middle East and Mexico. Drawing inspiration from Raymond Williams's concept of 'emergent' as a cultural process of hegemony (Williams, 1977), Inhorn and Wentzell introduced the term 'emergent masculinity.' In their study, Inhorn and Wentzell (2011) focused on men's 'sexual embodiment.' They observed the rise of emergent masculinity in both countries, where men take pride in age-appropriate manliness as an essential aspect of their masculinity. While the concept 'of

'emergent masculinity' paved the way to a new dimension in the study of men, masculinity, and reproduction, Inhorn and Wentzell's focus on associating 'emergent masculinity' primarily with sexuality and reproductive aspects limited its applicability to specific contexts in the Middle East and Mexico. While their research provided valuable insights into the intersection of masculinity and reproductive technologies in these regions, it might only partially encompass the diverse dimensions of masculinity in other cultural settings or regions. Further studies are needed to explore how 'emergent masculinity' might manifest and be perceived in various societal contexts worldwide and in India.

Studies on reproduction and assisted conception in India focused their attention on the impact analysis of ARTs on women (Gupta, 2002), political economy of biotechnologies (Gupta, 2012; Sarojini et al., 2010); cultural conception of kinship and ARTs (Bharadwaj, 2016; Majumdar, 2017, 2021). However, all the studies conducted in India primarily centred around women as the subject of analysis. As a result, there has been a noticeable lack of research on men's involvement in reproduction in the context of assisted conception. To fill this gap in this chapter, the researcher attempted to do a thorough investigation on men, masculinity, and their reproductive role in India following the implementation of assisted reproductive technologies like ICSI and MAC. These techniques are used in the IVF cycle to cure male infertility. The lived experiences of men in the context of assisted conception are recorded to understand how men make meaning in the IVF network that contributes to the broader field of reproductive research. The concept 'masculinity' in this thesis does not represent an identity that fits into an ideological apparatus in an Althusserian way. Instead, the meaning of masculinity in this study is derived in a Bourdieusian framework, i.e., from how men construct a socially defined and normatively shaped identity derived from their sexual division of labour (Bourdieu, 2013). This form this identity men create in their daily lives and reproductive practices in a context where male infertility is visible and potentially cured (since it is medicalised) through assisted reproductive technologies.

As discussed in chapter four, women, particularly young women, often make significant sacrifices, such as giving up their paid jobs to undergo IVF treatment and care for the potential child. On the other hand, men's roles are often perceived by women as more rational decision-makers. However, limiting the understanding of men, masculinity, and reproduction by viewing men's experiences solely through the lens of women is inadequate. Exploring men's unique experiences from their perspectives and lived realities is essential.

In this study, men's encounters with IVF technology are examined not in direct comparison to women's experiences but rather in their lived experiences. This approach allows for an exploration of how men's experiences may be influenced by or may reinforce traditionally gendered power dynamics (Becker, 2000:16). In this chapter, men's experience with IVF is explored through the way they construct masculinity and reproduction in the context of adopting to assisted conception. Therefore, an attempt is made here to explore how men's prevailing gendered role impacts their acceptance of IVF technology.

This chapter delves into the construction of masculinity and men's infertility and their reproduction roles within the framework of their social embodiments in the rapidly changing world they inhabit. Moreover, understanding the dynamics of men's experiences with IVF technology requires an examination of their unique encounters, free from binary comparisons with women's experiences. By doing so, an attempt is made to gain insights into how IVF technology may influence or reinforce traditional gender roles and power structures associated with men and masculinity today. Thus, this study examines men's encounters with IVF technology through their lived experiences. This approach allows for an exploration of how men's experiences may be 'influenced by or may reinforce traditionally gendered power dynamics' (Becker, 2000, p.16). This chapter is based on narratives collected from eighteen men respondents, categorised as nine from the Hindu upper caste, eight from the OBC (Other Backward Classes) Hindu community, and one from the OBC Muslim community. These diverse perspectives provide valuable insights into the experiences and perceptions of men from different backgrounds about the subject.

Reimagining Reproductive Responsibility: Men's Journey after Discovering Infertility and Seeking IVF

This theme discerns men's perception of reproductive vulnerabilities and choice of IVF. Conception and reproduction are the desired expectations in marital relations. Instead, men in our society generally hide their infertility due to the stigma attached to male infertility. Historically, reproductive masculinity expects men to provide financial assistance and women for childbearing and rearing. This 'social division of reproductive role constructs masculinity identity' (John Farley, 1984, mentioned in Daniels, 2006, p.12-29). Chapter three has highlighted that historically; the study of sperm and male infertility received less attention compared to women's infertility. During pregnancy procedures, the focus was on studying the female body's exposure and behaviour to determine the risk of congenital disabilities. At the

same time, little emphasis was placed on exploring the male contributors of sperm. This historical "social imaginary" contributed to assigning men a secondary role in reproduction (ibid:30). This notion became a social construction over time.

Recently, modern science and reproductive technologies started recognising male infertility and started offering a solution for the same (ibid:12). Apart from medicalisation and normalisation of male infertility, men's perceptions and subjectivities are shaped by cultural ideologies and practices (Chopra, 2009), influencing how they respond to the identification of male infertility. Besides the medicalisation and normalisation of male infertility, men's attitudes and personal perspectives are strongly influenced by cultural ideologies and practices (Chopra, 2009), which significantly shape their responses to identifying male infertility. Cultural attitudes toward discussing reproductive health significantly impact how men approach the concern. Men are less likely to share their concerns or seek professional assistance in societies with a lack of open conversation about fertility problems or where such discussions are considered taboo.

In interviews conducted for this study, men expressed similar views toward reproduction and infertility. However, it was evident that those who acknowledged their infertility and consented to the conception journey through IVF technology did not conform to the existing cultural ideal of a perfect, strong, masculine reproductive body. These men expressed vulnerability about their reproductive bodies and their emotions. The study discusses men's roles in the IVF process, how they interpret and accept male infertility or sub-fertility, and the treatment involved. Throughout the interviews, many expressed deep regret and guilt for not being as supportive as they could have been during their wives' early medical consultations for conception. Their narratives revealed a sense of responsibility and a willingness to confront their infertility through IVF technology. This demonstrates a shift away from the traditional notions of masculine reproductive roles and a willingness to embrace vulnerability and emotionality in the context of reproduction. Some of the narratives are as follows:

Roshan (pseudonym), age 30, has been married to his cross-cousin for six years. He belongs to the Hindu upper caste. He is from the old city of Hyderabad. Nowadays, he lives with his wife near his workplace, which is close to the hospital where they are doing IVF. He is a veterinary doctor earning approximately fifty to sixty lakhs per annum. As the male family member, he has always emerged in the public sphere to make money for the family. In his narrative, he shared how he played a victim to the traditional belief of gender reproductive roles, how IVF

technology helped him identify male infertility, and how this technology changed his imagination of 'reproductive masculinity.' In his words,

We started consulting a doctor a year after my marriage when we realised that my wife's menstruation was irregular. In the early days of consultation, I would hardly consider that I could have a problem. Initially, I was given some iron tablets to consume, but I did not take those because I used to believe I was fine and healthy. I never thought I could have any problem. When the doctor pressured me and asked me to stop blaming the woman alone for the pregnancy problem, I started consuming those tablets and doing all the required tests. Only recently, I found that I have some problems. During the IVF process, I learned that my sperm motility is low.

Rajeev (pseudonym), age 35, graduated as an art consultant in a private company. He hails from an upper caste, Hindu religion, and lives in Patancheru, about 30 kilometres from Hyderabad. He earns approximately three lakhs per annum. He said,

First, we consulted regular gynaecologists. We started IVF for the last six months when the "normal treatment" did not work. Initially, we thought my wife had some problems and was the only one taking treatment and not getting a good result. After coming to this hospital, I learned it was not my wife; I had a problem. My sperm count is not good (said in a lowered voice). We have already tried two rounds of IVF. However, I did not undergo any treatment or medical checkup. Nevertheless, it failed because of my problem. This is our third round, and it is done along with my treatment. I feel guilty knowing my wife is bearing so much pain for me.

Rakesh (pseudonym), age 43, hails from a Hindu upper caste. He and his wife work as primary school teachers. Their mutual annual income is about 5.5 lakhs. He said,

We could not figure out its cause when we failed in the last two IVF cycles. Later, when we came to this hospital, they asked me to do some medical tests. They said that I have some problems. They are charging extra money for my treatment. I have not undergone any treatment like my wife did before. I have only taken a few medicines and given my samples. In this third cycle, embryos have been formed. They are yet to be transformed. It is very late that I understood a man could have a problem. Otherwise, my wife is always questioned most of the time.

Amit (pseudonym), age 48, is a graduate and a businessman who has been married for fifteen years. He earns an annual income of approximately six lakhs. He belongs to the Hindu religion of the OBC community and is originally from Kurnool, Andhra Pradesh state. During the interview, he said,

It is too late for us to conceive naturally. When we tried to conceive naturally, my wife consulted a general gynaecologist often. That time, I never consulted doctors for the

same because we were never told I could have any problem. I never gave it a thought. We have tried to conceive for years but have not achieved success. We were not aware of IVF technology at that time because we lived in a village. Recently five years before, we learned about IVF from some of our friends and the internet. When we started IVF, we had to undergo some medical examinations. There, we found that my sperm count was very low, and her egg qualities were not up to the mark. That time, the doctor suggested to go for IVF. This is the only option we have.

Ishit (pseudonym), age 29, MBA, works as a Finance Officer. He earns about seven lakhs annually. He belongs to a dominant caste from the OBC of the Hindu religion. He has been married to his cross-cousin for four years. He said,

I never thought men could have any fertility-related issues. IVF helped to identify my problem. This treatment is a very exhausting and painful procedure. I am mentally and physically exhausted now. I am coming to the hospital almost every day along with my wife. After all, she is very weak now, and how can I let my wife come here alone? It affects my work, and my money is drained by this treatment like anything. But I have no option. I am very lucky that my wife is supporting me with my problem. When she is happily taking all the pain, my responsibility is to take care of finances and my wife's physical and mental health. I want to see her happy after we successfully give birth to a child.

There is one common response in all these narratives: men presume that conception is a natural process and women are the natural bearers of a child before they start IVF. Technological intervention in the once-called private field of reproduction has changed this historically shaped cultural imagination of men. Initially, men assumed that wives were solely responsible for fertility issues. This aligns with traditional gender norms that often burden women with reproductive responsibility. All the respondents mentioned above suggested that they made their wives undergo infertility tests, and none of them had an iota of doubt about their infertility. This highlights the social stereotypes about masculinity and female infertility.

However, upon visiting a hospital specialised in IVF treatment, they discovered the issue was a man's low sperm count or related causes. This revelation challenged the preconceived notion of men, masculinity, and their relation with reproduction, highlighting the importance of considering both partners in the diagnostic process. These diagnostic tests have brought attention to the power dynamics, gender norms, and assumptions that shape individuals' experiences within the reproductive area. The changes in the 'reproductive area' emphasised the significance of inclusive and holistic approaches to reproductive healthcare, where both partners are actively engaged and receive appropriate medical attention. It reveals the need to

challenge traditional assumptions and gender norms surrounding infertility and highlights the importance of comprehensive diagnostics and inclusive approaches to treatment.

Assisted Reproductive Technologies (ARTs) have played a crucial role in enabling men to fulfil their masculine role in contributing to reproduction while challenging the longstanding stigma attached to male infertility. With the advent of IVF, men's involvement in the process of reproduction has transformed, moving away from the traditional aggressive and so-called "masculine" attitude to one characterised by vulnerability, emotionality, and empathy towards their female partners in a marital marriage relationship.

In this context, a fascinating theme emerges concerning how men secretly undergo IVF procedures under the veil of women to protect family honour. This choice is influenced by cultural norms and expectations surrounding masculinity, which may view male infertility as threatening family reputation and lineage. By assuming this disguise, men attempt to shield themselves and their families from potential societal judgment and ridicule associated with infertility. They take on a more supportive role in the IVF process, allowing their female partners to be the public face of the treatment, which may align better with conventional expectations. This concealment of male infertility can be seen as a coping mechanism within certain cultural contexts, where traditional notions of family honour and masculinity are deeply ingrained. This practice also sheds light on the complexities of gender roles and societal pressures surrounding fertility and reproduction. It signifies a shift towards a more nuanced understanding of masculinity, allowing men to express care, concern, and vulnerability while actively participating in conception. The secret practice of IVF by males to protect so-called family honour is discussed below.

Navigating the complex interplay between male infertility, family honour, and the quest for an IVF secret treatment

Honour is a cultural construct that places significant importance on an individual's reputation as perceived by others (Brown, 2016; Cohen et al., 1996). Male infertility is associated with impotence; men are called 'imperfect men' (Evans, 2016). This invulnerability of masculine honour affects manhood as it threatens man's power in society and family. Therefore, unlike women, men choose to keep their infertility secret. As discussed in chapter two, women tend to hide male infertility and take all the blame to protect the 'family honour' associated with a man's reputation. Under this theme, the research brings out narratives describing how men navigate male infertility with masculine honour by calling it family honour. In the following

narrative, men have expressed a sense of insecurity about their manhood upon diagnosis of male infertility and upon undergoing infertility treatment through IVF. A few narratives are as follows:

Ramesh (pseudonym), age 45, an upper caste person married for ten years, resides in Sangareddy town, about fifty kilometres from Hyderabad. He graduated in science and has worked as a lab assistant in an educational institution. He earns approximately seven lakhs per annum. He is very conscious about the revelation of their IVF treatment, which he thinks might bring doubt to his masculinity and it would affect family honour. He said,

This kind of information should be confidential. Once we reveal our intention to go for IVF treatment, people will gossip and make stories about us. Choosing IVF is not easy for me as it is a matter of my manhood. People around us will not understand how important it is for us to have a baby. But if they come to know that we are using IVF, everybody, including my family, will start questioning the genetic link of the prospective child. So, we are keeping this treatment secret.

Ramesh associates his infertility with his sense of manhood. Despite his educational background, he discreetly undergoes IVF treatment while his wife bravely takes on the responsibility and safeguards the family's honour. Similarly, Rakesh, age 43, grapples with concerns about his masculine pride and anxieties surrounding the stigma of impotence. He says,

My wife had taken enough treatment in the beginning. I was not even comfortable going to the hospital for infertility treatment. We cannot tell anyone about my problem. Not only do they bring up the question of my impotence, but they may also show a finger at my family ancestors. So, it is better to do IVF silently without many people knowing. My wife is very supportive and says nothing about my problem to anyone.

Rajeev, age 35, has shared his concerns about the potential threat to his masculine honour if his situation were exposed to society. The fear of judgment and questioning his societal standing weigh heavily on him, leading to insecurity and anxiety. In his words,

With the help of this technology, we can achieve parenthood without revealing our struggles to others. The thought of people discovering my condition fills me with immense embarrassment. My family's reputation hangs in the balance, and not just that, my entire clan's honour could be called into question. However, I have come to support my wife throughout this treatment fully, and she too eagerly desires to experience the joys of motherhood. Thankfully, our journey toward parenthood is progressing smoothly and bringing us hope.

Unlike Rajeev, Ramesh, and Rakesh, who openly discussed their male infertility in the presence of an unknown researcher who does not belong to their society, others kept their fertility test details confidential. They attribute this decision to the notion of honour, considering it a personal matter. Instead, they redirect the conversation towards their wives' treatment process, emphasising the importance of supporting their spouses during the journey towards parenthood. By doing so, they appeared to be protecting their perceived masculine honour while still acknowledging the significance of the overall treatment process.

Rohit (pseudonym), a 34-year-old MBA graduate from Rayalaseema, Andhra Pradesh, belongs to the Hindu OBC community. He works as a finance officer in a private company in Dubai but temporarily stays in Hyderabad for IVF treatment. With an annual income of approximately 20 lakhs, Rohit unintentionally revealed his male factor infertility during our interview. However, he quickly felt uncomfortable discussing his fertility issues and directed the conversation toward his wife's experience as the primary focus of their decision to pursue IVF. He said,

I prefer not to share further details about the semen infection. It is a personal matter, and I would rather focus on the positive aspects of our IVF treatment and the journey toward parenthood. My wife also has some egg-related problems (kept silent).

Roshan, age 30, expresses his reluctance to openly disclose his sub-fertility issues further due to his importance on family honour. He feels it is a matter that should be kept private and not openly shared with others. He said:

I know infertility treatment is like any other treatment. But my family will make a big issue if they find out about it. So, please excuse me; I cannot reveal more about my treatment details.

It is important to recognise that the narratives presented in these scenarios highlight certain cultural dynamics and beliefs surrounding male infertility, secrecy, and societal perceptions. They depict male infertility as a secret medical condition, often kept hidden, while female infertility takes the forefront during IVF treatment. This dynamic can reinforce the perception that women's bodies are inherently prone to failure and unpredictable and men are 'hegemonic that embodies the most honoured way of being a man.' Furthermore, when women take the blame for male infertility, it perpetuates the assumption that fertility issues primarily stem from women, reinforcing gendered stereotypes and expectations and 'legitimising the subordination of women to men.' However, these narratives discussed here reflect specific cultural contexts

and are not applicable universally. Infertility experiences and their dynamics can vary significantly across societies, cultures, and individual perspectives.

Negotiating reproductive choice: Unpacking the influence of hegemonic masculine culture on men's decision-making of IVF

In this theme, we delve deeper into the influence of dominant hegemonic masculine culture on men's decision-making ability regarding IVF treatment. Hegemonic masculinity is a historical concept shaped by gender power dynamics and normative principles. As previously discussed, women face significant social pressure to give birth within an ideal reproductive age despite their strong desire to become mothers. However, it is important to recognise that men and their reproductive choices are not free from social and cultural pressures and heteronormative values. The dominance of heteronormative and patriarchal on women's reproductive decisions are also highlighted in chapter four of this thesis. Besides, scholarly work on reproduction discerns how assisted reproductive technologies (ARTs) have brought about a new form of patriarchy, where conception is seen predominantly as a female experience (Rothman et al., 1989). However, in this theme, it is argued that hegemonic masculinity is not natural. Rather, the exercise of hegemonic masculinity in assisted reproduction and reproductive choices is also shaped by social and cultural pressures and heteronormative values.

The social and cultural expectations surrounding marriage and fatherhood, especially at an idealised age, continue to shape men's reproductive decisions. These expectations pressure men to conform and become fathers within a socially constructed timeframe. The narratives gathered from interviews for this study reveal that prospective fathers undergo these pressures. Additionally, many narratives discuss how their wives face immense social pressure and criticism from family, friends, and relatives, which ultimately affects the couples' decision to pursue IVF treatment after experiencing difficulties in conceiving naturally. It is important to recognise that this social pressure is not solely an individual problem but a challenge couples face. Men's intervention and support alongside women are crucial in achieving the shared goal of parenthood. It is worth noting that most men interviewed for this study are older than their female partners, with an average age gap ranging from three to seven years and a few exceptions with a ten-to-fifteen-year gap. This age gap also adds pressure on some men to become fathers within a certain timeframe, like the way women are expected to be mothers immediately after marriage. In their narratives, men expressed their experiences with social pressure and the choice of ART.

In the second interview, Roshan (age 30) shares how his wife has faced bullying and criticism from their relatives during family functions. This social pressure and the desire of his wife to become a mother have played a significant role in Roshan's decision to choose IVF to achieve parenthood. In his narrative, Roshan consistently emphasises fertility and conception as primarily a woman's subject. As a man, he is supportive even though he is the primary decision-maker in the reproductive area. Their challenges led them to explore assisted reproductive technologies such as IVF. He says,

Before doing IVF, I was advised by the doctor to undergo surgery to process the normal pregnancy of my wife. But my wife could not wait. She is only 24 years old. But she wants a child desperately. Even the doctor asked us to wait and try for a natural pregnancy. But she does not want to wait. It is not her fault. Indian tradition forced us to be desperate to have a child. Indian tradition means the pressure of father, mother, sisters, and other family members. We can live normally without a child, but society will pressurise us. "My wife cries sometimes, particularly when alone and during her monthly menstruation." This is a sentimental issue. If you go to a function, relatives pock you for not having a child because it has been five years since we married. They will call her '*godralu*,' which means barren, the one who cannot give birth and never become a mother. In this way, they (mothers-in-law, fathers-in-law, uncles, and aunties) offend us. Sometimes, when we go to the village, without my knowledge, my sisters and other cousins take my wife to the village God and make my wife worship there to solve the infertility issue. They believe having infertility issues is a curse and primarily blame my wife.

Rakesh, age 43 and his wife have faced significant criticism from their relatives due to their inability to have a child. This criticism and societal pressure have had a profound impact on their lives. Rakesh's wife even stopped attending family functions, and he stopped visiting their relatives' homes. During that period, Rakesh and his wife were unaware of the possibility of IVF as a treatment option. They felt disheartened and gave up hope. However, when they consulted a doctor specialising in IVF, they were informed about Rakesh's specific fertility issue. Before that, no other doctor had identified the problem. This revelation provided them with newfound hope. He said,

We have faced many criticisms from our relatives for not having a child. My wife stopped going to family functions. I even stopped going to a relative's house. That time, we gave up because we were not aware of IVF. Before starting IVF, no doctor ever told me about my problem. But when we consulted a doctor here for IVF, they identified my problem.

Now, we have used this treatment. I am happy that we have the option. At least we will have our own child in our old age.

Amit is a 48-year-old from Kurnool and his wife have faced numerous challenges regarding their childlessness. One of the difficulties they encountered was the judgment from others who assumed their decision not to have children was due to their income level. Amit and his wife experienced blame from both their in-laws and their parents. They were frustrated by the lack of understanding from people who failed to realise that they, too, desired to have children. Amit and his wife attempted some ayurvedic treatments initially, but unfortunately, they did not yield positive results. Amit underwent treatments to increase his sperm count, but unfortunately, his efforts proved unsuccessful.

Eventually, he and his wife decided to seek IVF treatment, which promised them a solution to Amit's infertility issues. He said,

We have faced many challenges. People would say, "You do not have a good income, so you avoided having children. My in-laws and my parents have blamed us all the time. People do not understand, even if we want to have kids. We did some ayurvedic treatment in the beginning. We have taken treatment in Kurnool. Some would say this doctor is not good; that doctor is good. They have given treatment to increase sperm count. We have tried all possible ways but are still looking for something to work. Then finally we came here. In Kurnool, the treatment cost is less, but the treatment could be better. Here, it is very expensive, but the treatment is good.

Amit's narrative sheds light on his and his wife's challenges, including societal judgments and the struggle to find the right treatment. Their journey involved trying various approaches and seeking guidance from different doctors. Ultimately, he decided to invest in a more expensive but promising treatment option, prioritising the chances of achieving their dream of having children.

Ishan (pseudonym), a 35-year-old businessman from an upper-caste Hindu background, is in a consanguineous marriage. His wife is twelve years younger than him, which seems to shield her from criticism regarding their childlessness. However, Ishan is subjected to shameful comments and judgment from various people, including relatives, parents, neighbours, and even shopkeepers he interacts with regularly while purchasing groceries. The societal pressure and expectations placed upon him as a man to become a father by this age are evident in how he expresses his frustration. Both Ishan and his wife have been diagnosed with fertility issues.

Given their diagnosis, IVF appears to be the only option for Ishan and his wife to fulfil their desire to become parents. Ishan's primary focus is to be a father. He said,

My wife is about twelve years younger than me. So, people do not criticise her for being childless. I mean my relatives, parents, neighbours, and shopkeepers, where I regularly purchase groceries. All these people make shameful comments about me because I am still not a father at this age. We both (my wife and me) got diagnosed with some issues. Nevertheless, the woman has more problems (said frustratedly when his wife went to the scan room). We have no other option than to do IVF. I want to be a father.

Ishan's narrative sheds light on the gendered nature of societal expectations surrounding fertility and the pressure men face to conform to traditional norms of masculinity. In this context, there is a tendency to veil men's infertility issues under women's treatment, thus protecting men's social image and shielding them from potential judgment or stigma.

The societal construction of masculinity often heavily emphasises virility and the ability to father children. Men feel immense pressure to fulfil these expectations, and when faced with fertility challenges, it becomes a source of personal shame and insecurity. This shame and guilt leads to a reluctance to openly discuss or confront the issue, as it could be seen as a threat to their masculine identity. In the protection of masculinity identity, men show reluctance to openly share their infertility details, as opposed to the willingness of women to discuss their experiences, as seen in the previous chapter. Societal expectations and norms surrounding masculinity emphasise strength, virility, and the ability to father children. Men feel compelled to conform to these ideals by choosing IVF and ICSI as choices that promise to help protect their strength and masculinity.

Male emotionality in the context of IVF: Does it affect masculinity?

The relationship between male emotionality and masculinity is complex and can vary across cultures and individuals. Traditional notions of masculinity or Connell's (1983) hegemonic masculinity' associate strength, self-reliance, and emotional stoicism as defining characteristics men seek to protect to retain their masculine identity (Courtenay et al., 2000; Carrigan et al., 2018). Hegemonic masculinity is a generalised form of masculinity practised by most to defend patriarchal dominance (Coles, 2009; Connell, 1995, 1998, 2005, & 2016). Hegemonic masculinities constitute 'traditional' idealised masculinity, which validates control, strength, and lack of empathy or emotional control (Kimmel et al., 2008). Hegemonic masculinity is

portrayed as an idealised form that reinforces gender power dynamics, often subordinating or marginalising women. The prevailing belief associates vulnerability or emotional expression with weakness or femininity. However, in the narratives explored within this theme, men display emotions typically associated with feminine identities without challenging their dominant masculine power. Instead, they exhibit empathy and emotional support for their female partners undergoing IVF cycles for either male or female infertility, presenting themselves as responsible and supportive partners in the marriage. Behind their support, their primary goal remains to achieve fatherhood or parenthood, reflecting the couple's interests rather than men's desires. Men deploy this characteristic emotionality while passively engaging in the IVF treatment process, driven to protect their masculinity by fulfilling the role of a husband and meeting societal expectations of becoming fathers. Below are some outlined narratives that exemplify these dynamics.

Vishal (pseudonym), a 40-year-old Hindu OBC man, has been married for 13 years and runs his own successful pharmaceutical company, earning approximately 20 lakhs annually. His wife is a housewife, and they have a thirteen-year-old daughter together. Recently, they decided to undergo IVF treatment, and his wife has started taking hormonal injections. Vishal empathises with her struggles and understands that managing both the treatment and household chores can be overwhelming for her. He tries to support her as much as he can, but due to his busy work schedule, he cannot provide as much assistance as he would like. In his words,

We have a daughter who was born naturally. I am happy with my present family. But my wife gets bored at home after I go to the office and my daughter goes to her school. My daughter is thirteen years old now. My wife is thirty-eight years old. I own a pharmaceutical company. Since I work in a similar field, I know IVF is an advanced technology that can give us our desired child. IVF can help us treat my wife's infertility problem as she has already crossed the age of thirty-five. I am happy with one child. Nevertheless, my wife wants another child, and I am earning well. So, I think having two children to have a complete family is ideal. I respect my wife's sentiment. I am happy that we have advanced technology like IVF to fulfil our desires at this age.

My wife started taking hormonal injections. But she is so panicked. She fears injections. Nevertheless, she must take an injection in this treatment. She is always thinking that she will have many side effects during and after the treatment. She also does all household chores. I can understand my wife's difficulties in managing the treatment and household chores. I try to help her, but I go to the office in the morning and return in the evening. So I do not get time to help her. I even work on the weekends. She feels good and confident

if I come to the hospital with her. That is why I managed to reduce her pain by accompanying her to the hospital.

During the second interview with Vishal, his wife was resting in a hospital room when the frozen embryo transfer (FET) was done. He expressed concern for her well-being and requested the interviewer to see his wife so that she felt comfortable. He shared his initial hesitations about undergoing IVF, as he was unaware of the extent of pain and stress his wife would have to endure. Nevertheless, they decided to proceed with the treatment because his wife felt it was an ideal choice, and they both desired to have two children. In his words,

Would you mind going to that room (pointing to a room in the hospital)? Today, my wife got her embryo transferred. She is taking a rest there. She is in much pain and stressed as well. Men are not allowed inside as there are some other women taking rest inside. She might feel happy if you go inside and talk to her. I did not want her to undergo IVF because of all this pain. However, she said she is getting bored at home, and it is ideal for us to have two children. Also, I earn a good amount. So, I thought, why not have another child? We two and our two. But I did not know she had to endure all this much pain for this.

Vishal's actions and emotional involvement in supporting his wife during the IVF process reflect his empathy and care. Despite his initial reservations, he understands the importance of the treatment to fulfil their desire for a more prominent family. He tries to ease her pain by accompanying her to the hospital and seeking comfort and support when he cannot be present. This narrative exemplifies how men can exhibit emotionality and actively participate in the IVF journey while upholding traditional masculinity and fatherhood ideas.

Umesh (pseudonym), a 29-year-old man from Rajamundry, belonging to the OBC Hindu community, works as a finance officer in Hyderabad, where he and his wife have temporarily relocated for IVF treatment. His annual income is about seven lakh rupees. During an interview, Umesh opened up about the challenges on their IVF journey. He expressed that the process has not only placed a financial burden on them but also affected his wife's mental well-being. He acknowledges his wife's immense stress and struggles during the strenuous IVF process. Despite the difficulties, Umesh remains steadfast in his commitment to support her and continue trying until she achieves pregnancy. He said,

Apart from my financial burden, it is also a mental burden for my wife. I know she is going through much mental stress. IVF is a strenuous process, but we must try until she

gets pregnant. I can understand that I can give her emotional and financial support, but I cannot share the pain that she is experiencing. But what to do? We will have to try.

Umesh realises that while he can provide emotional and financial support, he cannot fully comprehend or share the physical pain that his wife experiences throughout the IVF treatment. Nevertheless, he remains determined to be by her side and face these challenges together, understanding that the path to parenthood through IVF may not be easy but is worth pursuing. Umesh's willingness to empathise with his wife's struggles and offer support showcases the importance of emotional understanding and commitment in such a challenging journey.

Rajeev, age 35, further shared his heartfelt concern about his wife's pain during their IVF journey. Despite earning approximately three lakh rupees per annum, Rajeev expresses a strong desire for a positive outcome from the advanced technology used in the hospital. He hopes they will be successful in conceiving this time, sparing his wife from further pain caused by infertility. His wife's suffering weighs heavily on him, and he acknowledges that they feel compelled to continue the treatment despite their difficulties. Rajeev said,

My wife has gone through much pain. This hospital uses advanced technology. I wish to get good results this time so that my wife does not have to endure further pain. It is more painful to see my wife in pain for my infertility. But we have no choice.

On the other hand, Arpit (pseudonym), a 32-year-old IT engineer with a B.Tech degree, earns a decent annual income of twenty-five to thirty lakh rupees. He has been married for six years and belongs to the upper-caste Hindu community. Despite understanding the potential pain of advanced technology in IVF, Arpit and his wife prioritise having their 'own child' above all else. They acknowledge the risks and are willing to face them head-on because they believe having a child is their ultimate goal. He said,

I know the more advanced the technology, the more pain it carries. I understand, but we must take this risk as we do not have a choice, and having our child is our priority now.

These two narratives shed light on the emotional and financial aspects of the IVF journey for two different couples. Both Rajeev and Arpit express their determination to endure the challenges of the treatment, driven by their deep desire to have a child of their own. The narratives also highlight how couples from various backgrounds and income levels share similar motivations and struggles when pursuing IVF to start or expand their families.

Rajveer (pseudonym) is a 33-year-old from the Hindu upper caste. He is originally from Rajasthan and settled lives in Hyderabad for occupation. He has been married for eight years and works in IT after completing his B-Tech degree. He says they (he and his wife) initially postponed the treatment due to concerns about its potential consequences. In the beginning, Rajveer was sceptical about IVF, fearing the hormonal imbalance and side effects it could cause to his wife. Despite these apprehensions, he eventually agreed with his wife to proceed with IVF, as they had no other choice. While Rajveer was open to adoption, he understood his wife's strong emotional attachment to experiencing motherhood through pregnancy and childbirth. He recognises that IVF technology has become a means for them to fulfil their desire for parenthood, aligning with societal expectations. He said,

We have postponed IVF treatment for a long to avoid its anticipated consequences. I had a perception that IVF is not good for the body, especially for women's bodies. I have read a lot about IVF. Then, I decided, along with my wife, to start the treatment. There are several injections inserted into women's bodies. That will cause a heavy hormonal imbalance. We were avoiding IVF, anticipating all these side effects. But ultimately, we ended up doing IVF because there was no choice. My wife wants to experience motherhood by taking all the pain. I do not want her to take all the pain; I am ready to adopt a baby. What is the logic in using donor treatment and bearing all the pain to have a baby? Nevertheless, I can understand her emotion attached to her desire to experience motherhood through pregnancy and giving birth. After all, our society also wants us to give birth and achieve parenthood by other means. But I never like to use donor eggs or sperm to have kids.

Piyush (pseudonym), a 34-year-old lab assistant from a village in the Warangal district, belongs to the Hindu religion OBC. He admires his wife's bravery and resilience during their IVF journey. He acknowledges that he requested her to undergo the treatment, and she willingly endured the pain to achieve their goal of having a child. He expresses gratitude for her commitment and strength, understanding that the temporary pain leads them towards the joy of soon holding their baby. He said,

My wife has carried so much pain in IVF treatment just because I asked her to do the treatment. She is very brave. When we were doing liposuction surgery to lose weight, I often fell into depression. But my wife remains strong. If it were some other woman, she would have left me and never taken all the pain for a child. I am so grateful to my wife for doing everything for me. I can understand the pain she is bearing now. But this is temporary. She is already pregnant. I know we are soon going to hold our baby in our hands.

Roshan, age 30, said,

I feel bad that my wife suffers so much pain from my problem. I know I give money, but she takes all the pain. Due to advanced technology like ICSI, my problem is resolved. But that treatment does not give me much problem compared to how much pain my wife bears. It is an exhausting process. I am a veterinary doctor. Every day, I treat many animals. I know medical technologies for human needs are more advanced than those for animals. But unlike animals, we humans face the challenge of both physical and emotional problems. Apart from this physical pain, my wife has taken all the blame on her head imposed by society for not being able to become a parent in an ideal time. She was called 'godlaru' (barren) for my sub-fertility problem. I can sympathise with her. At the same time, having a child is also important for both of us.

Rohit, age 34 has made significant sacrifices by quitting his job and temporarily staying in Hyderabad for IVF treatment. While he and his wife wish to expand their family, they have not disclosed their decision to their educated parents, fearing they might experience pain and struggle to see them undergo the IVF process. Despite Rohit recognising the physical and emotional imbalances his wife is enduring with the IVF treatment, his determination to continue it shows the importance of having a child and expanding his family. However, Rohit felt awkward to interact with the researcher in the beginning. In the second interview, he spoke about his vulnerabilities and supportive role in his wife's IVF journey. He further reiterated,

My wife does not feel good about herself when she sees other women in her kin group enjoying their motherhood. I do not think there is anything wrong with her thinking. I also believe this is the right time to expand my family. That is why I have quit my job and am presently staying in Hyderabad with my wife temporarily, only for IVF treatment. That itself is a big sacrifice. Furthermore, doing it all alone is also a challenge. My parents are educated. They have advised us to go to the best doctor in the city. That is what we did. However, we have not informed them about IVF. They might feel pain. They cannot see us doing IVF treatment. They cannot see us in pain. I also understand my wife is undergoing a lot of physical pain and emotional imbalances, but we must do it. As a man, my job is to support her financially and emotionally, which I am doing.

Himat (pseudonym), a 29-year-old finance officer from Rajahmundry, Andhra Pradesh, belongs to the Hindu OBC community and has been married to his cross-cousin for four years. He and his wife are staying in a rented house in Miyapur, Hyderabad, for IVF treatment. He said,

When we first got to know about the fallopian tube blockage issue, we thought about the options available for a child. The first option we thought about was to adopt a child. We

thought of going to an adoption centre and adopting a child. I was happy to adopt a child. After all, a child is a child. But when we were ready to adopt, the government restrictions and procedures became stumbling blocks. We have to for a long time to adopt a child, as per the procedures. Later, when we learned about this treatment, we thought of giving it a chance. Moreover, my wife wants to give birth to our child only. I know it is a painful procedure. Nevertheless, it is my responsibility to support her. When she is ready, why should I create a problem? I try my best to keep her healthy and happy during the procedure. My wife is happy that we have another option to have our child through IVF.

Himat's willingness to explore different options and his understanding and support for his wife's desires highlights the importance of mutual decision-making and compassion in their journey toward parenthood. By embracing IVF, they have found hope and happiness, knowing that they now have another option to have a child of their own.

The narratives presented here provide valuable insights into the diverse experiences and emotions that couples go through during their IVF journeys. In these accounts, men supported their wives, emphasising the significance of achieving fatherhood status. This pursuit of fatherhood allowed men interviewed for the study to maintain their hegemonic masculinity within their society. It is essential to note that men's desire for parenthood through IVF does not necessarily imply a motive to dominate or exploit women using this technology. Contrary to what radical feminist scholars label as patriarchal, men's experiences in the IVF process often reveal a very important partnership with their wives, if not an equal partnership, concerning their bodily involvement in the treatment process.

Furthermore, the narratives portray 'men-as-supportive-partners' in the intimate realm of reproduction, offering emotional support to their wives and taking on the responsibility of providing financial assistance for the IVF treatment (Chopra, R. 2009, p. 119). The accounts of men's involvement in IVF journeys challenge some conventional assumptions and stereotypes. They highlight the importance of shared desires and equal partnership between spouses as they navigate the complexities of IVF with empathy and understanding. It is observed from the field that men as supportive partners provide financial support to the IVF treatment process, which most of them find challenging and burdensome. While discussing the financial challenge, men during the interview often expressed their vulnerability and need to have their 'own child,' which is important to discuss to understand men's agency in assisted conception.

Reproductive masculinity: Navigating financial burden and reproductive choice

Men's role as breadwinners and caregivers is a distinctive site for formulating hegemonic masculinity. Women have increasingly participated in paid jobs recently, but the notion that men are the primary breadwinners is historically shaped in specific cultural contexts. Men's breadwinner and caregiver roles locate them materially and symbolically in the culture of household reproduction (ibid:125). In contrast to men's positioning at the centre of household financial responsibilities, women are often situated at the core of the reproduction of offspring. They are expected to take on the caregiving role.

Conversely, societal expectations dictate that men provide financial support within the familial context, especially in the realm of reproductive endeavours. However, as discussed in the preceding chapter, it is noteworthy that the predominant financial responsibility often falls upon the natal family of women, who are primarily tasked with bearing offspring for the family unit. Despite the complexity, IVF treatment's financial expenses are a recent phenomenon when couples face challenges in conceiving naturally and seek alternative paths to parenthood. The financial burden on men results from the couple's IVF choice. The broader capitalist system also influences this new form of reproductive choices resulting from technological advancements in the reproductive field. The commercialisation of IVF technology has made it an expensive option for couples. During the study, it was evident that many men interviewed willingly took on the financial responsibility of covering the cost of IVF treatment, regardless of whether the infertility stemmed from male or female factors. Most of the men discussed under this theme are in their mid or late thirties, with few in their mid-forties and early fifties. Though it is difficult to know their exact income, they belong to either lower-middle income with an annual income of fewer than five lakhs or upper-middle-class families with an annual income of five lakhs to thirty lakhs.

Moreover, some couples were found to be undergoing repeated IVF cycles. Within this theme, the researcher explores how men perceive and navigate the financial burden of their reproductive choices. Some of the narratives are discussed below:

On hospital experience, Rohit, age 34 wishes to avoid any reference to the hospital as he feels that doctors and the management take control once anyone like him enters a hospital, dictating what needs to be done. He finds the commercialisation of healthcare disheartening, where treatments are offered only after payment. Despite acknowledging their service, Rohit hopes

that his wife's IVF treatment will be covered by insurance, but for now, his ultimate aim is achieving their shared dream of becoming parents. In his words,

I feel everyone should stay away from the hospital if they can. Once you enter the hospital, the doctors and the hospital management will take over your life. They will say you need to do this; you need to do that. We only must respond to what they say and do what they ask us to do. It is very much commercialised. Until we pay the bill, they will not treat us. We will hand over the payment receipt first, and then they will do the treatment. The bill comes in multiple instalments. They call it service. What kind of service is this? If it was only a service, why are they charging so much? Yes, I agree that they provide service after the payment is made. I wish no one should go through this treatment in their life even if we know that this system is exploiting us, but still, we must live with this system. This treatment should be covered by insurance. Nevertheless, we do not have an option other than doing it. We want to become parents; that is the ultimate truth.

Ram (pseudonym), a thirty-four-year-old businessman from Bangalore, belongs to the upper-caste Hindu religion. He chose to start their third IVF cycle in a new city, i.e., Hyderabad. He sais,

Nowadays, the treatment is commercialised. We have faced the same problem in Bangalore. Nevertheless, this hospital has a good name even outside. We know that they have got a good embryologist here. Even though it is a little expensive here, we get good treatment here. The main thing is that we will not get any side effects here. I make money for my family. IVF is helping us to have a child. That is the reason we choose to come here, to this hospital.

Ibrahim (pseudonym), a 54-year-old married contractor from the OBC Islam community, resides in Hyderabad. He shares his concerns about the high cost of IVF treatment, which exceeded his expectations. He said,

I asked Madam (doctor) how much this treatment would cost. She said it would be about two lakhs. Nevertheless, in the last four months, we have already spent double the amount, i.e., four lakhs. The IVF package cost is 2.5 lakhs. In other places, it is 1.5 lakhs. Here it is very expensive. We travel by train to this city for IVF whenever asked to come. Travel costs, eating food outside, and other expenses we made in this city are additional burdens to the IVF treatment cost. The auto charges Rs. 200 from Nampally (railway station) to this place. After coming to this hospital, I checked online for other IVF centres. When I compared, I found this place is more expensive. People go to less expensive places. Right now, I do not have a job. I have financial problems as I am living on savings. I had no option but to sell my wife's jewellery to finance the treatment. Since I

have used all my savings to make a house, I do not have any more money. I want to see successful results through IVF.

Rajeev, age 35, from Patancheru, Hyderabad, further expresses his understanding of IVF's advanced technology. However, he finds the treatment cost exorbitant, causing financial strain for common people like him. Despite financial challenges, his resilience to carry forward IVF treatment proves his dedicated role as a breadwinner to his family, who decidedly contributed financially to the reproductive role through IVF treatment. He further said,

I can understand this is an advanced technology. But why is it so costly? We are common people. It is very difficult to go through a financial crisis while doing IVF.

Rakesh, 43-year-old primary school teacher from an upper-caste Hindu family, further shares his infertility treatment journey. He has faced significant financial strain, having spent around fifteen lakhs and taken loans to finance multiple IVF cycles. Despite the challenges, Rakesh values the importance of having a child and remains dedicated to fulfilling that dream. He said,

In our infertility treatment journey, we have consulted six to seven doctors and have spent almost fifteen lakhs. Two IVF cycles cost more than six lakhs, excluding other tests and medicines. With teacher jobs and govt salaries, it is not easy. I have used almost all my savings. I pay directly to the hospital. No EMI or late payment facilities are available in this hospital. They (the hospital) take money first and then do a treatment. This treatment is not covered under health insurance. This is the problem in India. Starting IVF early in our life was difficult because my income was less. I have only 15 to 20 thousand in income per month. As I said before, I have saved money for four years and spent that money in the first two cycles. I have now taken a bank loan for this (third) cycle. Nevertheless, what value does money carry if we do not have a child? Having a child is more important than saving money. We are still not so old that we cannot afford to care for our children. Once we have a child, we will work hard to give the child a better life.

Arun (pseudonym) is a 39-year-old contractor and a real estate businessman from the OBC Hindu community. He emphasises the uncertainty surrounding IVF success. He acknowledges the double burden of his wife quitting her job for the treatment but feels there is no other option available. He said,

Nothing can be said now. There is no guarantee that we will be successful or not. Even my wife has quit her job for the treatment. I asked her to leave her job for now. It is like a double burden, but I have no other choice.

Amit, 48-year-old businessman from a Hindu OBC background, shares the financial challenges they faced throughout their infertility journey. He highlights the expensive nature of IVF treatment, which led them to save money for years to afford it. In his words,

After some point, we learned that we had no option other than to do IVF. We have delayed this treatment because we had no money to start it. It is a very expensive treatment. They charge from one lakh to three lakhs or even four lakhs. It is not easy. My parents stay with me. We live in a joint family. I must take care of everyone. What to do? We must do it. Every month, we keep savings in the bank for years and then come for the treatment.

As Amit continues to voice his experiences, he expresses frustration with doctors who offer no clear explanation for IVF failures and advocate unnecessary tests. Despite the difficulties and costs involved, Amit and his spouse are determined to continue pursuing IVF to have their own child. Amit's wife said,

When treatment fails, they do not give any reason. God knows what exactly went wrong. One month after embryo transfer, they did a scan and said everything was good. But again, when we did the scan in the second month, they said that the embryo was not growing inside the uterus. After the second month, they said there was no growth and no heartbeat. They gave me some tablets to eat and asked me to clean the uterus the next day. They did not even give us the time of fifteen days. Here, they charge 20 to 30 thousand rupees to clean the uterus in this hospital. But we did it in Kurnool for five thousand. If we had done it here, we would have paid twenty to thirty thousand. It is costly here. It is challenging to come and get treatment with all the difficulties. But we still take all the risks and do the treatment, spending a lot of money; doctors do not take any responsibility for everything. It is well enough if we succeed, but the doctor will not take responsibility if we fail. It will be our responsibility. Doctors should be more responsible. If they at least tell us the success or failure rate before starting the procedure, it would be easy for us to decide whether to go for the treatment or not. Despite everything, we continue IVF because having our 'own child' is more important than thinking about money.

Arpit, 32-year-old, and his wife works in IT. They both earn an income of approximately twenty-five to thirty lakh per annum. Arpit moved back to India from Dubai to undergo IVF due to the high medical expenses there. With Hyderabad known for its renowned infertility centres, they have prioritised starting a family despite the temporary relocation and financial considerations. He said,

I have quit my job in Dubai and come to India only to do IVF. It is not a small decision. In Dubai, medical expenses are very high. IVF is furthermore costly, which is not affordable for us. Instead of doing it there, we thought we would save lots of money if we did it in Hyderabad. After all, Hyderabad infertility centres are world-famous. Moreover, having our 'own child' is our priority now. We plan to stay here for five to six months until my wife conceives. Then she can stay with my parents so I can return to Dubai for work.

Ramesh, age 45, further shares his perspective on the commercialisation of IVF technology. He believes that while IVF is an advanced treatment option for infertility, some doctors exploit patients by withholding information and recommending unnecessary tests. In his narrative, he expressed his financial struggle, which he thinks is a man's supportive role in the IVF journey. Despite these challenges, Ramesh and his spouse are determined to continue with IVF to have a child.

IVF technology is highly commercialised. I can understand that this is an advanced technology in reproduction. Nevertheless, few doctors are exploiting people. They do not tell the exact problem of IVF failure. They unnecessarily ask us to do many optional tests. Doctors should understand patients' perspectives. We are already in stress. When IVF fails to give us positive results, it feels like all the money we invested went in vain. It creates double stress. The doctor should take responsibility for providing the right information so that it becomes easy for people like us to make the right decision. However, the truth is we have nothing in hand. We follow what the doctor says. Since IVF is the advanced treatment option to solve our problem, we are doing this despite its high cost and facing other challenges. If some other technology comes that may cost more than this, we will still be doing that to have a child.

Analysing this narrative from the perspective of reproductive masculinity and utilising science and technology studies (STS) approaches, we see how the respondent's reproductive choices are intertwined with the financial constraints imposed by biomedicines and biotechnologies like IVF and ICSI. The high cost of IVF treatment and the lack of insurance coverage highlight the inequities and challenges faced by individuals and couples seeking fertility treatments in India. The narratives shed light on how masculinity is shaped by men's desire for a child and their willingness to endure financial struggles to achieve that goal. It highlights how reproductive decisions are not based on scientific aspects or universal principles of rationality but are deeply influenced by societal norms, personal economic conditions, and individual aspirations. As observed from the narrative, men in the field of assisted conception perform the role of a 'supportive partner' rather than mere bystanders. They actively express their

vulnerabilities, voicing frustrations and anxiety stemming from IVF treatment's high cost and uncertainty. For many, the path of IVF leads to considering donor treatments, which presents social and moral challenges that men find difficult to accept, adding financial burden to their journey. The social and moral dilemmas men experience in choosing donor treatment are discussed in the following theme.

Social and moral dilemmas and emotional ambiguities in donor treatment decision-making for men

The theme of 'Social and Moral Dilemmas and Emotional Ambiguities in Donor Treatment Decision-Making for Men' explores men's challenges and conflicts when considering donor treatments as part of assisted conception. This theme delves into the complex emotional and ethical aspects men face in their journey towards parenthood, where deciding to opt for donor treatments can be deeply impactful and riddled with uncertainties. Emotional ambiguities in this context entail cognitive orientation, feelings, public morality, and cultural ideology. According to the cultural anthropologist Geertz (1980), expressing human emotions and feelings is never free of cultural shaping and meanings. Geertz argues that 'without culture, we would simply not know how to feel' (Geertz, 1980). The juxtaposition of cognitive orientations, cultural ideology, and public morality keeps the capability of bridging the gap between body and mind, society or individual, and body politics. As a result, emotions transfer knowledge into human understanding, bringing intensity and commitment to human action (Blacking, 1977). Men hold ambiguities in accepting donor insemination as a result of these cultural values that they internalised in their social conditioning. At the same time, the emotion attached to the desire to have a child lies in the natural process of giving birth, guiding their decision to choose IVF technology.

Further, these emotions are not limited to their human instincts; they can be seen arising from social needs to become a father or produce descendants to their family. Besides, they face a moral dilemma in choosing donor insemination. They compromise their moral dilemma with the fact that pregnancy through IVF gives them the satisfaction of at least having a child through a natural process of giving birth, which is opposite to the mere adoption of a child. The moral ambiguities and emotional needs shape the donor treatment choice of men in the assisted conception.

After experiencing a failed IVF cycle, their doctor suggested a donor option to Rajveer. While Rajveer's wife is open to the idea, he opposes using donor eggs or sperm. Rajveer believes having a biological child is paramount as he believes a biological link fosters stronger emotional attachments. Adoption is not preferred due to uncertainties about the child's caste, religion, and biological connection. He said,

The reality is we should try our best to get our 'own baby' first. A biological child will have a more emotional attachment to everyone. We have consulted at many places. I also underwent surgery. But that did not work as well. So, we chose IVF as the alternative option. The doctor advised us to consider the donor option since we have already experienced one IVF cycle failure. My wife is ready to choose even the donor option. But I am against donor eggs and sperm. Using a donor egg or sperm is an even worse option than adoption. Practically, that is not possible. In adoption, we will not know the caste and religion of the child; similarly, how we will identify the caste and religion of the child. More than that, the child will not be biologically our own. I would not like to do this. If we are trying for medical treatment, it should be our own baby (biological).

Rajveer's stance reveals the significance he places on a biological connection with his offspring. Despite the challenges, he is determined to continue pursuing IVF in the hope of having their 'own biological baby.'

In the second interview, which was conducted after some months, Rajveer reveals that they have decided to go for the donor option because his wife is determined to experience the journey of motherhood and wants to conceive a child at any cost. Despite Rajveer's initial opposition to using donor eggs or sperm, he has realised the importance of fulfilling his wife's desire to become a mother. Rajveer's love for his wife and understanding of their limited options have led him to support her decision. He acknowledges that even if the child is not biologically related to him, he will still feel connected through the conception process and be there with his wife throughout the journey. He said,

My wife wants to conceive, and I love her. So, I cannot say no to her because we do not have other options. At least I will connect to the child in the conception process of the child.

This decision showcases the couple's strong bond and willingness to compromise on their initial beliefs to fulfil their shared dream of becoming parents. Rajveer's statement reflects the depth of his love and commitment to his wife and their future child, regardless of the biological connection.

Ibrahim, age 54, is a married man from the OBC community with the Islamic faith. He worked as a contractor in the Gulf region for most of his life, amassing a desired amount of wealth. He has decided to return to India and start a family using IVF technology. Ibrahim's primary concern is maintaining his family lineage and blood connection with his prospective child. While he compromises by using donor eggs, he places less value on his wife's biological linkage to the child, highlighting the influence of patriarchal ideologies in family dynamics. His wife's role is reduced to being a carrier of a male descendant, indicating a subordinate position for women in reproduction. Despite compromising his religious and moral values, Ibrahim emphasises fulfilling personal and social needs through assisted conception. His age and concerns about crossing the ideal reproductive age add to his helplessness, leading to his acceptance of using donor eggs in their IVF journey. Maintaining secrecy in their treatment becomes vital to Ibrahim due to the cultural and social implications attached to using donor eggs. He said,

See, I have given my life to my career. I have worked hard and made some money. When I was young, I could have taken my wife to my workplace or Gulf to stay with me. But there, a woman's life is complicated. I remember she came with me once. That time, she made many complaints as she could not leave the room and had no friends and family there. She then decided to come back to Hyderabad, India. After that, she hardly stayed with me. Later, when we tried to adopt a child from our relatives, they denied it to me. In Islam, adopting a child from outside the family is haram. Later on, we came to know about IVF technology. Initially, we were asked to go for donor eggs and sperm as my wife and I had crossed the ripe fertility age. I convinced doctors to use my sperm. Initially, my wife did not agree to donor eggs. Nevertheless, we do not have enough time, strength, and money to undergo many IVF cycles. I know it is haram in Islam to use others' eggs. Somehow, I convinced my wife that at least she would carry the baby. So, the child will be her blood, and no one will doubt her.

Mahesh (pseudonym), age 45, has been married for ten years and belongs to an upper-caste Hindu religion. He works as a lab assistant in an educational institution, earning approximately seven lakhs. He faced various struggles in his early life, including delayed marriage and subsequent challenges with fertility due to his increasing age. Initially, Mahesh was adamant about having a genetic link with his prospective child. He hesitated to consider donor treatment due to moral ambiguities about raising a child who would not be biologically related to them. However, after undergoing three failed IVF cycles and facing financial constraints, Mahesh eventually agreed to use donor insemination. The urgency to secure his family and the uncertainty of IVF results influenced his decision. Technology and the complexities of assisted

conception led him to compromise his beliefs and thoughts about biological connection. Regarding IVF and donor insemination, he said,

See, I am not born with a silver spoon. I have worked hard and made a career for myself. Even today, I do not have a permanent job. I am working as a contractual lab assistant at an educational institution. Because of a delay in my career, I married late after I crossed the age of thirty-five. Without knowing much about the treatment, we have undergone three IVF cycles. I was very stubborn about my genetic link with my prospective child. I have had a lot of moral dilemmas because the child will not be of my blood. With all rigidity, I did not choose donor insemination. As a result, all our previous IVF cycles failed. We have limited savings; most importantly, I do not have time. Giving birth to our child is more important than thinking about donor insemination. We have heard that this hospital maintains secrecy in treatment. I have shared this with you because you are educated and unknown to us. The doctor said that no one would even come to know that we have used donor treatment (said without explicitly mentioning the details of donor treatment).

During the second interview, Rakesh, age 43 bravely opened up about his struggle with male infertility in the initial interviews. In the following interviews, he discreetly expresses his willingness to consider using donor sperm to fulfil his desire for a child. As he nears the end of his reproductive age, Rakesh feels the urgency of becoming a father, considering it a matter of great importance. For Rakesh, the prospect of not having a biological child has been causing him and his wife significant emotional pain. In their conservative society, adoption is not readily embraced, adding to the pressure to conceive naturally. Rakesh profoundly cares for his wife and cannot bear to see her suffering due to their inability to conceive. He yearns to experience the joy of raising and playing with their 'own child,' which has become a fundamental part of his understanding of family life. However, Rakesh faces a dilemma due to the prevailing societal norms and his masculine identity. He fears that sharing his decision to pursue donor insemination, which is seen as unconventional, may lead to ridicule and social ostracisation by his relatives. Despite this, he takes the risk because his longing for a child outweighs the potential consequences. He said,

I am already in my late forties. If not today, I cannot be a father later. I am not supposed to share this with anyone because you are a stranger. I am sharing it with you. Everyone wants to have their 'own child.' We live in a conservative society where adoption is not easily acceptable. I cannot see my wife in pain for not having a child. I also want to play with and raise our children. If I tell my cousins about IVF, they will suspend us. And if they get to know about using donor treatment (donor sperm since he told me in the beginning that he was diagnosed with infertility issue), they (relatives) will mock me and

make my life miserable. We have got the embryos transferred. All I want is for the child to look like us.

In all these narratives, prospective fathers emphasise having their "own" child, reflecting the significance of biological connections with their desired children. The decision to consider donor options varies due to individual factors such as age, social security, family support, and personal beliefs, making the negotiation process complex and challenging. Despite socioeconomic differences, most of the prospective fathers interviewed in this study are willing to compromise their desire for a biologically related child with the idea of simply conceiving a child, even if the child may not have a biological connection to either of the parents. This compromise is driven by various factors such as societal expectations, cultural norms, personal beliefs, age-related concerns, and the desire for family lineage.

Discussion

The identification and treatment of male infertility through IVF technology result in reconfiguring centres and nodes of authority. Traditionally, men assume an authoritative role in reproduction, often believing in the perfection of their bodies. This belief was evident among the men interviewed for this study. The first theme of this chapter, 'Reimagining Reproductive Responsibility: Men's Journey after Discovering Infertility and Seeking IVF,' explored a significant transformation in men's perceptions from authoritative to expressing male emotionality. Their once stoically perfect body image gave way to a recognition of vulnerability. It disturbed their lives as they navigated identifying and addressing their infertility in IVF treatment.

Upon identifying male factor infertility, men have expressed a range of emotions, including sorrow, shame, and guilt, when reflecting on their experience with IVF technology. They interpret their infertility as a challenge to their authoritative male role within the confines of their families and even in the public domain, feeling that their bodies have failed to fulfil societal expectations. From their perspective, IVF technology has allowed them to regain lost power and authority. This perspective differs from feminist arguments that IVF reinforces patriarchy and heteronormative ideals.

Drawing from the second theme of the chapter titled 'Navigating the Complex Interplay Between Male Infertility, Family Honour, and the Quest for an IVF Secret Treatment,' it is evident that IVF technology is reshaping masculinity by keeping male infertility a secret while

enabling men to perform their 'reproductive masculinity' under the veil of women. Besides reinforcement of gender stereotype practice taking place, men in this context are also redefining their role in reproduction, moving away from the traditional notion of aggressive dominance over women's bodies. Instead, they are embracing a new perspective on reproductive masculinity, where they seek medical and technological assistance to enhance and strengthen their "conjugal connectivity."²¹ This shift challenges gender norms and aims to gain acceptance within their society (Inhorn, 2011).

Under the third theme of this chapter, i.e., 'Negotiating Reproductive Choice: Unpacking The Influence of Hegemonic Masculine Culture on Men's Decision-Making of IVF,' it is argued that men experience extreme social pressure to achieve a fatherhood identity like women experience stigmas in female infertility. This social pressure derives from the local culture, which normalises men, masculinity, and their relation to reproduction. Men in their narratives expressed a fear of being called '*napumsak*' or impotent, shaping their decision to choose ARTs as an alternative option to protect their manhood identity. Apart from protecting manhood identity, men have shared an emotional experience with wives and empathised with them in this journey, enabling them to choose IVF even in the case of female infertility.

The theme of 'Male Emotionality in the Context of IVF: Its Impact on Masculinity' offers a fresh perspective on the emotional experiences of men in the realm of reproductive technology. While some feminists argue that IVF perpetuates patriarchal norms, enabling men to control women's bodies, this study highlights a different dimension. It reveals that men often assume a supportive role during the IVF process, providing emotional and moral encouragement to their partners. The fifth theme of this chapter, i.e., 'Reproductive Masculinity: Navigating Financial Burden and Reproductive Choice,' continues to describe men's supportive role in the reproductive area, particularly their experience with the financial burden. An argument is made under this theme that despite women's financial contribution to the family, men continue to play the breadwinner and are held more responsible for providing financial support in the IVF

²¹ ²¹ Marcia Inhorn (2011) used the concept of "conjugal connectivity" in the context of 'Middle Eastern men who are socialised to be deeply enmeshed in family structure'. Such connectivity is internalised by men in their socialisation process, which they practice in later life after marriage to live in a loving and bonded conjugal relationship. Extending family through giving birth to offspring is one of the elements of this conjugal connectivity.

treatment cycle. In coping with IVF's uncertainties and financial burdens, men openly express their frustrations and anxieties, showcasing emotions and vulnerabilities that challenge traditional notions of stoic and robust masculinity.

The final theme explored in the chapter revolves around 'Social and Moral Dilemmas and Emotional Ambiguities in Donor Treatment Decision-Making for Men.' This section critically examines the notion of having 'own child,' a concept frequently encountered in the narratives. The theme delves into the complex moral ambiguities, societal and cultural expectations, and dilemmas men face when deciding between using donor eggs or sperm. Throughout their narratives, men consistently emphasise the desire for an 'own child,' which they associate with a biological connection. However, this concept of having an 'own child' becomes complicated, where men opt for donor eggs and sperm. The idea of 'own child' is compromised, often leading to resistance against conventional social norms and giving rise to moral dilemmas associated with the idea of a biological child.

These findings of the study suggest that man has transformed from the beginning of the IVF process to its end. The socio-historically defined and culturally internalised dominant form of masculinity role as a provider of sperm to the conception has changed into a more supportive role within the conception process. In the newly emerging form of masculinity, a man eventually started an attitude towards reproduction and conception. This 'emergent masculinity' embodies feminine somatic, repudiating maleness. This emergent masculinity imbibed male emotionality, a locally and culturally produced vulnerability. Despite male emotionality, men maintain the conventional hegemonic masculinity by keeping IVF a secret treatment and naming it a female area of concern. Due to prevailing stigmas attached to male infertility, ARTs like ICSI are majorly practised as a complement treatment in IVF. The secrecy of male infertility and its treatment through ARTs in the IVF cycle is maintained and normalised even by medical practitioners, which is elaborately discussed in the next chapter. Similarly, the medicalisation of the female body and its naturalisation and normalisation are often used as a tool by medical practitioners to legitimise IVF technology, which is discussed in the next chapter. Apart from medical practitioners, a response from other actors like the state, media, and market are also discussed in the next chapter to bring out a holistic perspective on the IVF network to understand the relationship between social technical in the IVF context.

CHAPTER SIX

SHAPING REPRODUCTIVE CHOICES: CO-CONSTRUCTING TECHNOLOGY, LAW, MARKET AND MEDIA

Introduction

Latour (1987) argues that the boundary between science and technology is frequently blurry and proposes viewing them as a single entity, which he terms "technoscience." Technoscience refers to the intersection of science and technology and how they shape and reshape each other. Technoscience is a social phenomenon shaped by the interests and values of the individuals and institutions involved in its production and is not merely a reflection of objective reality (Latour, B. 1987). Technoscience of IVF technology is discussed here as a network in which the researcher discusses technology as 'small, yet powerful; diluted, yet concentrated ' (ibid, P. 181).

The medical and social field is studied here in a non-binary relation. It is argued here that medical and social areas are interconnected, like IVF specialists (medical practitioners) and aspiring parents belonging to the same society, where gender roles, family, and kinship values are situated. These values shape prospective parents' reproductive Choices, which are already discussed in chapters four and five of this thesis. The study field denotes that scientific knowledge is produced and reproduced from social and moral values endowed by the everyday practice of technology. The everyday practice of IVF technology involves the interaction of various actors, both human and non-human, material and non-material, such as medical practitioners, gamete donors, paramedical staff, prospective parents and their family members, the state, the market, the media, and the technology itself.

This chapter discusses the interconnectedness of actors, including medical institutes, the state, the market, and the media. An argument is made here that these actors exist in a network relationship. The agency of these actors is discussed in this chapter in terms of network relations they form in the everyday practice of IVF technology. This chapter delves into the intricacies of the sociotechnical network formed by the interplay among the market, the state, technology, medical institutions, and the media. It systematically examines these actors' reciprocal influence on one another within the in vitro fertilisation (IVF) network. Through this analysis, the chapter elucidates how these key stakeholders collectively contribute to stabilising the overarching IVF network over time.

Part I

Legitimising IVF technology and reproducing heteropatriarchal ideology by IVF fertility centres

Conception in the technology age is no longer a private domain, which earlier restricted its access to family and mid-nurses in the private sphere. Conception is medicalised and technologised mainly in the aftermath of ARTs, particularly after the innovation and use of IVF. However, medical practitioners, the primary actors of medical institutions, are not free of social and moral values. Therefore, in this relatively new field of reproduction, medical practitioners use traditional family and kinship values and values of gender roles to legitimise IVF technology. This new way of practising medicine and medical technology is taking place in an 'unequal economic structure' that has already debarred those who cannot afford the high cost of the treatment (Sarojini et al., 2011).

This part of the chapter explores how medical institutions act as actors that operate by the actions of medical practitioners and other paramedical staff and IVF technology. Furthermore, the IVF centre as an 'institutional actor' is elaborately discussed in the way it shapes the reproductive choices of aspiring parents opting for IVF treatment. The researcher aims to study how medical practitioners legitimise IVF technology among prospective parents from various backgrounds like IT, corporate, rural, urban, etc. Based on the findings from the study, it is argued here that most IVF specialists and medical practitioners perform the role of a 'moral pioneer' who uses societal values and norms attached to motherhood, family, and kinship institutions to shape aspiring parents 'reproductive choice' with the 'hope technology.' IVF is a technology legitimised by putting hope in its practice and results. By placing this hope through technology, IVF medical practitioners glorify motherhood and tie traditional kinship family values with the genetic relation of parents and children. The way medical practitioners operationalise these values to legitimise IVF technology is discussed in this chapter.

The norms and values attached to conception and giving birth to 'own child' is inherently based on gendered, heteronormative principles that allow only married heterosexual couples to conceive and give birth to their offspring in India. In legitimising IVF technology, heteronormative ideology, traditional family, and kinship norms are reduced in a relatively new form. Traditionally, kinship is understood as a biogenetic ties between 'parents and children ties,' which are fundamentally anticipated to have emerged from the 'natural facts' of procreation (Schneider 1980, Strathern 1992). Technological intervention in the realm of

conception allowed second and third-party interventions such as conception through artificial means, donor insemination, genetic treatment, etc. Though this kind of conception has not erased the traditional form of kinship construction, it has brought changes to a certain extent. It has reconstructed kinship and family institutions in a new record. In other words, medical practitioners legitimise IVF technology by 're-traditionalising heteronormative ideas of motherhood' by reconstructing traditional family and kinship norms (Kumkum Sangari, 2015). Medical practitioners emphasise the need for IVF treatment in today's changing world, where people have adopted many lifestyle changes (emphasis is more on people working in IT sectors). While both male and female infertility rate is increasing worldwide (Inhorn, 2005), conception remains a women's problem (Patel, T. 1994). In the study of fertility behaviour in Rajasthan village, Tulsi Patel (1994) contends that in a patriarchal society, barrenness, which is associated with women's infertility, is considered as a dreaded condition; a curse, which causes social and emotional distress for women. According to Patel, a barren woman's status gets further lowered in a male-dominated society because her fecundity is often doubted. On the other hand, male fertility is seldom questioned. Men are hardly expected to undergo fecundity tests.

Following this argument, the first theme of this chapter discusses how IVF fertility centres perform gender normalisation to legitimise IVF technology. Data used in this chapter section was drawn from narratives of the medical practitioners interviewed during the fieldwork.

Gendered normalisation of infertility stigma by Medical Practitioners

Under this chapter theme, the researcher discusses the construction of conception as a gendered problem where medical practitioners assign women as the primary players in human reproduction. They emphasise motherhood as married women's ultimate identity and that IVF technology is helping women to achieve motherhood identity by overcoming the problems of infertility and its associated stigma.

An IVF and reproductive medicine specialist, Dr. M. Reddy (pseudonym), said,

I am helping those couples, mainly women with IVF technology, who face problems in conceiving. Many women are facing lifestyle problems because the couple works two shifts. Most of them work in IT. When one spouse has the morning shift, the other will have the night shift. How will they have children? Also, drinking, smoking, late-night parties, etc., negatively affect their reproductive health. Women are also nowadays actively practising that. Most of my clients come from the IT sector.

Working women are very ambitious concerning their careers, and on the other hand, they want to have families. They want to conceive and give birth to their offspring and become mothers. After all, who does not want to have their 'own child'? Despite everything, women are always questioned for not conceiving and giving birth. I am helping them fulfil their desire to have their own family to conceive and give birth through IVF technology".

While continuously emphasising kin-making as women's responsibility, she further added,

These technologies are the new hope for couples. IVF has become the only hope for people who do not have children and have lost hope in all other treatments. Recently, we had a couple who had been married for fourteen years. They got a child through IVF. For some reason, they were struggling to conceive. The woman was 38, and the Man was 44 years old. They did not even imagine that something like this could happen to them and that they could have a child at that age. Finally, they have a complete family, which was possible only through IVF technology. Most importantly, that woman is out of guilt now. She no longer feels she failed to give birth to her family's offspring. They call it miraculous technology. Yes, this technology works as a miracle for some.

The managing director of a famous fertility centre in the city, Mr Rao (Pseudonym), said,

We have been working to wipe out women's tears. We have sympathy for women. In our society, people still live in superstitious beliefs. Women are not allowed in family functions and worship if they are not giving birth or having a child by a certain period of their marriage. They are offended and misbehaved by other relatives. I have heard stories from women about how their family members treat them like criminals.

While refereeing to class differences, Mr Rao further added,

This practice still exists among the lower middle class. There exists a massive difference between people having or not having a baby. Unlike a woman who is very independent economically, belongs to a higher society, and lives in a posh society like Sushmita Sen, they can adopt. Otherwise, giving birth to their child is the only alternative option for many. Everyone needs a baby of their own to feel the completeness of life. Today, pollution is increasing, and because of lifestyle, many face infertility issues. Women these days are getting married late due to career priorities. Nevertheless, they all belong to the middle or lower middle class. This kind of society constantly questions women if they fail to conceive and give birth despite their having a standard economic status and being highly educated.

Another doctor, Dr S. Roy (Pseudonym), said,

IVF is not a controversial technology. It is a natural process like any other treatment, which helps women to meet their dreams of achieving motherhood. Every woman wants to become a mother. IVF is a blessing for them. IVF is the ultimate solution for them to become a mother.

Dr L. Reddy (Pseudonym), an IVF specialist associated with a branch of a very famous multi-speciality hospital located in a posh area of Hyderabad, said,

We live in a country with a large population. The question is, do we need IVF treatment in this country? Nevertheless, in this case, we are talking about the general population. What about the infertile couple who do not have children? They cannot just adopt a child. Psychological factors are associated. What will happen to the future of the child? You know most of the people in India live with their kids.

Moreover, many couples are living together only for their kids. In this case, how will they adopt? What do women have to withstand with society if she is infertile? Childlessness is a huge issue in India. Society mistreats people if they do not have their 'own children.' So, no one has the right to tell them to adopt. I think adoption is better than fighting with medical treatment. Moreover, it is their personal Choice. For which I feel they must go for IVF. So, these are the issues. We should give them a chance through IVF. Furthermore, IVF is not a bad practice. It is not an abnormal thing. It is a normal process. We only fertilise an embryo outside the womb and then transplant it into the womb. So, they have the 'abstraction' of having their 'own child.'

Though the market uses parenthood through conception as a strategy to legitimise IVF technology, in the words of medical practitioners, the desire for motherhood shapes people's IVF choices. These narratives restructure the idea of motherhood as a 'natural' act, which is important to meet societal expectations and build an identity. Infertile men and women face a lot of social stigmas due to their 'biological lack.' As per the words of medical practitioners, they are helping those infertile couples by 'giving nature a helping hand' (Franklin, S. 2006). In other words, IVF is a choice that most married heterosexual couples make, mainly women in this context with certain medical conditions. Reproductive Choice through technology assistance is a common phenomenon observed in rural and urban areas, as per medical practitioners' experience.

However, medical practitioners' narratives emphasise that conception and giving birth are not mandatory for women of all classes. Technological assistance to give birth to 'own child' is understood as a middle-class phenomenon. Drawing from these narratives, the researcher argues that although infertility remained a women's problem, IVF emerged as a 'hope technology' for women (married heterosexual women). Despite infertility and motherhood desire affecting people of all classes, the commercial use of IVF technology is promoted in this context by centring the motherhood values of women belonging to the middle class. Moreover, men who choose IVF under the veil of women's infertility. To thoroughly understand how

medical institutions use gender role values, the following theme of this chapter discusses 'gendering infertility stigma in the area of 'masculine reproduction.'

Male infertility: Gendering infertility stigma

Technologies like intra cytoplasmic sperm injection (ICSI), Microfluidic and Magnetic Activated Cell Sorting (MACS)²², etc., have been used in IVF treatment to cure²³. According to medical practitioners, this recent development in the IVF network not only adds to more IVF success rates but they have also challenged the stigmas attached to the gendered nature of infertility. Not only are men asked to undergo medical tests to confirm their infertility, if any, but unlike before, many men are now seeking medical help using ICSI and MAC.

Though male acceptability of infertility is not accessible as it still carries many stigmas, many have started adopting this new way of treatment through advanced biotechnologies. Despite a shift in understanding male infertility and adapting new assisted reproductive technologies, infertility remains a 'women's social burden' (Inhorn, 2015b). This 'women's sentiment' attached to 'motherhood' has been used by medical practitioners to legitimise IVF technology even for the treatment of male infertility.

Dr. Naidu (Pseudonym) said,

In Telangana, women are sent to us with their mothers if they do not conceive within six to eight months after marriage. Moreover, men hardly come to the hospital. If husbands come by chance, they will be adamant about their perfect bodies and resist undergoing medical tests. They call us the doctor with good hastavaaasi (a belief associating successful treatment with a doctor's hand). But we do not do any miracles. Generally, we are not supposed to go for IVF treatment unless one year has passed after marriage and unless both the couple undergo medical tests. I tell my patients, 'Do not blame only women.' 'Do not think you (to male patients) are perfect and women are defectives.' But now, people are counselled before doing IVF. We inform them about the physical issues of both husband and wife. Male infertility is treated in many ways, like by using ICSI. Nevertheless, the women are suffering and taking all the blame even if it is a male problem. Gender biases are observed in the majority of the cases. However, there are exceptional cases, mainly among upper-class people who support each other in IVF cases.

²² For details on these three techniques, see Chapter Three.

²³ The word cure is used here intentionally since medical practitioners and couples often describe infertility as a disease which, according to them, needs to be cured by IVF technology.

Dr. Naidu's experience with her patients shows that men in our society do not readily accept both male infertility and its treatment techniques. The limited few accept their infertility issue and adopt these technologies to treat male infertility with less social stigma attached.

While advocating the benefit of the ICSI technique, Dr. Manasa (Pseudonym) said,

ICSI is a more advanced form of infertility treatment used for male infertility. In this process, doctors insert one single sperm into one egg. In IVF, even if we fertilise the embryo in the lab, the fertilisation process still happens naturally. When it comes to ICSI, we have a better choice. Because in ICSI, the machine has big microscopes. In IVF or IUI, we can see the semen in small size in the microscope, but in ICSI, we can see it up to ten thousand times bigger size. So, we have a better chance of understanding which sperm is better. Most fertility hospitals, including ours, are now doing ICSI in IVF. This technology is taking IVF one more step ahead. However, we cannot call it a specialised form of IVF, but it is a more advanced treatment within IVF treatment than conventional IVF. Nowadays, most hospitals do ICSI in IVF. It does not matter if male factor infertility is identified or not. ICSI enhances success rate. Among my clients, I have noticed that women are blamed more despite male infertility.

Dr. M. Reddy said,

We have IVF and IVF-ICSI. ICSI is intracytoplasmic sperm injection, i.e., in each egg, we will inject a sperm. Nowadays, in most cases, we are doing ICSI only. Previously, we used to do only IVF. IVF means eggs and sperm are incubated and left to get fertilised on their own in the laboratory. ICSI is an advanced technology that adds more to conventional IVF's success. ICSI is done external to the human body. But ultimately, it is the women who conceive and give birth. That is the reason motherhood is so important in our society.

Dr L. Reddy further said,

See, IVF's overall success rate is increasing. Nevertheless, we must see why we use ICSI. When sperm cannot penetrate the egg, we make an additional effort by injecting sperm into one egg. We do this process through ICSI. Moreover, technologies like ICSI, PGS, PGD, etc., help increase the success rate because they are the most advanced technologies in IVF treatment in recent times.

Dr. P. Reddy (Pseudonym) said,

ICSI is a technique through which we inject one sperm with another healthy egg so that it increases the fertilisation rate. So, for male infertility, this is one of the best treatments we have now. Many techniques, like ICSI, MACS, microfluidic, etc., are used in IVF

treatment for better results and higher success rates. There are more options nowadays people have. It depends on who chooses what. Even today, many men do not accept that they could have any problem. Some men think only women can have problems. Nevertheless, people are educated nowadays. So, once we make the couple understand the details of IVF through our doctors and counsellors, they accept it. But some people, mainly from very conservative families and still into old thinking, take relatively more time. But after all, it is a question of their manhood. So, they must make a choice.

The narratives of these medical practitioners highlight the fact that ICSI and other related techniques are 'an assisted reproductive technology of choice' (Inhorn, 2015a), which is replacing its predecessor technology, IVF or the 'conventional IVF.' ICSI, MACS, and Microfluidic techniques provide its users with a guaranteed choice to create 'the elusive embryo(s)' (Becker, 2000). An elusive embryo implies the creation of an embryo by assisted reproductive technologies which has challenged 'natural' pregnancy or birth as it may involve doner egg or semen which may not be related to the prospective parents desiring to give birth. Despite increased assisted reproductive technologies developing within the IVF network, infertility remains a 'women's problem.' Therefore, women remain the first target of most infertility treatments, including IVF. As observed, in many cases, women take all the blame and hide male infertility to protect their family honour. As a result, it becomes women's responsibility to protect family honour and to extend family kin lineage. Therefore, motherhood continues to be glorified in the medical field by IVF specialists despite new ARTs developed to identify and find solutions to male infertility.

In this context, Dr. P. Reddy said,

Women take all the blame even if the problem is more from the male side or a man's problem. This is the problem mainly found in rural areas. At least people in IT (as she is trying to depict urban infertility issues as primarily an issue of people who work in the IT sector) openly discuss their infertility issues irrespective of gender. I am not saying women are not blamed in urban areas. Their situation is relatively better in urban areas when and if she is earning. It is the society that has already created a gendered bias in infertility causes. So, we are more empathetic to women because their position is terrible compared to men.

In many cases, we also do not specifically say that ICSI and other techniques are used for male infertility treatment; these treatments are just described to patients as part of IVF. The reason for doing so is that men already feel awkward doing clinical ejaculation to give semen samples. If they know about their infertility, they will be more traumatic, which may affect the semen quality due to stress. After all, the women are carrying the child, not the men. So, if it is unnecessary or the situation demands, we do not tell men about their problem unless it is severe.

These narratives further imply that though the normalisation of male infertility has started happening in the medical gaze, the stigma attached to female infertility remains a significant issue. This stigma concerning women's infertility has been continuously used by medical practitioners as a mechanism even to cure male infertility. It is argued here that the development and operationalisation of male technologies like ICSI, MAC, etc., are not only a scientific response to male infertility, they manifest a masculine desire to carry forth genetic linkage to the next generation. Ironically, this masculine desire is fulfilled through technological assistance, either secretly or diverting its responsibility to women, even in the case of 'emergent masculinity.' Besides the gendered practice of ARTs in the IVF cycle, sex selection practices are a matter of discussion as they bring out ethical practices of ARTs mainly through IVF.

Eugenised embryo: Selecting sexed/gendered bodies

Parenthood, defined as the biological connection through the act of giving birth to one's own child, is frequently emphasised by medical practitioners as a means to legitimise the use of In Vitro Fertilization (IVF) technology. As discussed in preceding chapters, the IVF process is intricate, involving numerous invasive technological interventions, commencing with the collection of egg and semen samples and culminating in the transfer of frozen embryos. This procedure constitutes a temporally dynamic network continually incorporating new elements into its practice. Noteworthy recent technological advancements, including Preimplantation Genetic Diagnosis (PGD), Preimplantation Genetic Screening (PGS), Intracytoplasmic Sperm Injection (ICSI), and Endometrial Receptivity Array (ERA), represent additional facets integrated into the evolving IVF network. PGS and PGD, in particular, elicit considerable controversy due to the ethical concerns they introduce regarding the agency of life. These technologies facilitate selective birth based on sex identification or the identification of genetic diseases in reimplanted embryos. PGS and PGD employ techniques to discern sex by locating additional DNA in chromosomes, primarily in the X chromosome. An automated sorting machine, differentiating sperms based on detected chromosomes, offers a method for determining the sex of the gamete. Both PGS and PGD, deemed scientifically more promising, serve as alternatives to traditional sperm sorting techniques. In the early 1980s, PGD technology emerged as an alternative to post-implantation prenatal testing. Its clinical application, pioneered by Handyside et al. in 1990, aimed to avoid unsuccessful pregnancies (Handyside et al., 1990). This systematic integration of technological innovations and methodologies underscores the complexity of the IVF procedure and its dynamic nature in the realm of assisted reproductive technologies.

Introducing non-human entities into the discourse surrounding "life" instigates profound transformations in understanding and socially normalising technologically constructed forms of life. Despite persistent ontological debates surrounding the essence of life, the ethical dimension of utilising advanced technology for selective birth, whether for sex selection or the Choice of individuals with desired physical abilities, is a subject of extensive deliberation (Shenfield et al., 2003; Cameron & Williamson, 2003; Landeweerd, 2009). In in-vitro fertilisation (IVF), the incorporation of non-human elements, such as Preimplantation Genetic Screening (PGS) or Preimplantation Genetic Diagnosis (PGD), is contingent upon the medical and reproductive histories of individuals undergoing the IVF procedure. This chapter segment delves into the intricate interplay between PGD and PGS within the expansive network of IVF, contextualised alongside other participants, including embryo selection and the societal norms and values influencing their acceptability. Furthermore, an exploration unfolds regarding the intricate power dynamics inherent in the practice of PGD and PGS within the broader IVF network.

Preimplantation Genetic Screening (PGS) is typically recommended for women in their late thirties or early forties, as well as those experiencing recurrent pregnancy failure. The primary objective of PGS is the identification of chromosomal abnormalities in embryos, enabling the selection of genetically healthy embryos for subsequent implantation. Notably, PGS and sperm sorting have become prevalent in American and European societies, often employed for purposes of "gender and family balancing" (Bumgarner, 2007, p. 1298). In these societies, couples frequently utilise PGS for gender preselection, motivated by the aspiration to have a family inclusive of both male and female offspring. This phenomenon is notably observed in American print media targeting immigrants of South Asian heritage (ibid). Despite legal proscriptions against sex selection in India, the utilisation of PGS is permitted to detect chromosomal defects in pre-implanted embryos. Although discussions on sex determination practices remain discreet, the pervasive demand and desire for male progeny become evident in the narratives articulated by medical practitioners. This discreetly observed data underscores the complex interplay between societal preferences, legal regulations, and the evolving landscape of reproductive technologies.

Dr. Naidu said,

Many patients come for IVF intending to have a child of a specific gender, mainly boys. However, we do not entertain those people. We directly say no to them. Technologies are developed to help the genuine people who need help, not for those who want to misuse

them. We are not doing sex selection practice because we do the ethical practice of IVF technology. But you see, nowadays, many IVF centres are mushrooming in the city. Of them, many are not even registered under ICMR. Yes, there are doctors practising sex selection using these advanced technologies. The government should find and punish them.

Stating sex selection as illegal through PGD, Dr. M. Reddy said,

Some people intend to go for sex-selected birth through IVF. However, we do not encourage those practices. It is illegal in India. We have also mentioned that in our consent form and advertised it on our web page. It is mainly those whose first child is a girl who wants to have their second child as a boy. Otherwise, most people opting for IVF only seek a child, irrespective of gender.

While mentioning the correlation between the additional high cost of IVF treatment and prospective parents' Choice, Dr L. Reddy said,

IVF, overall, is a costly and invasive treatment. Additional treatments like PGD and other related techniques are even more costly. So, those people who are struggling years for a child do not see gender in their child. Yes, I agree that the demand for a son child still exists. Nevertheless, this is illegal in India. So, we do not allow that to happen. Apart from that, we do not ask every couple to go for PGS. It is those women who have experienced recurrent pregnancy failure whom we suggest for PGS to identify any abnormal chromosomal defects in the developed embryos. By doing this test, we can separate healthy embryos from defective ones. As a result, we can also increase the IVF success rate.

Preimplantation Genetic Diagnosis (PGD) is recommended for couples with a known genetic disorder in their family, particularly one stemming from a specific single gene mutation. PGD aims to ascertain whether an embryo has inherited the mutation and is predisposed to the associated genetic disease. This testing protocol is relevant in consanguineous marriages, where individuals wedded within close kinship share a common genetic heritage, a prevalent marital arrangement in Andhra Pradesh and Telangana. Within consanguineous unions, wherein both parents carry identical genes due to their familial relationship, PGD emerges as a crucial tool. Notably, the prevalence of PGD procedures is heightened in fertility centres in Hyderabad, reflecting the demographic specifics of consanguineous marriages in the region. The overarching objective of PGD is the selective transfer of genetically defined healthy embryos to the uterus, while embryos deemed abnormal may be either discarded or utilised for clinical research. Beyond the mere segregation of healthy and abnormal embryos, technology's role has evolved to encompass genetic engineering, enabling scientists and medical professionals to design infants according to specific, realistic specifications. However, it is

imperative to note that implementing this practice is currently illegal in India. This prohibition coincides with a rising parental inclination towards adopting advanced reproductive technologies, sparking debates around the ethical dimensions of such technological interventions (Sterri, 2020). These genetic screening technologies are often characterised as a 'new eugenic' or 'private eugenic' practice, distinct from historical instances of state-imposed eugenics (King, 1999; Gupta, 2007; Dickens, 2018). The contemporary discourse surrounding these technologies underscores the nuanced intersection of medical advancements, societal aspirations, and ethical considerations in assisted reproductive technologies.

The discourse surrounding selective birth through Preimplantation Genetic Diagnosis (PGD) is notably framed within three primary categories: the social model, expressivist objection, and the medical model. Originating in the disability literature of the 1970s and 1980s, the social model posits disability as a social construct and underscores how societal discrimination transforms individuals with impairments into disabled entities (Hughes et al., 1997). In contrast, the medical model of disability contends that disability and physical impairment are intrinsically linked (Shakespeare et al.; N., 2001). According to this perspective, disability results from a physical problem, typically a disease or physical impairment (ibid). The medical model advocates for medical interventions to treat the underlying conditions, asserting that addressing the medical aspects is paramount for mitigating disability. This model vehemently rejects the notion that disability is solely a social construct. In this context, PGD emerges as a logical extension of the medical approach to disability, positing that disability is a medical condition necessitating medical intervention. Consequently, proponents of the medical model advocate for the medical treatment or even the discarding of embryos with identified disability conditions before implantation for pregnancy. This perspective reinforces the premise that disability, in essence, is a medical challenge requiring targeted medical responses within the framework of assisted reproductive technologies.

In response to the medical model, a critical perspective known as 'expressivist critiques' has surfaced, contending that the utilisation of technologies like Preimplantation Genetic Diagnosis (PGD) conveys a detrimental message to individuals already living with a disability. These critiques posit that society inherently assigns lesser value to individuals with disabilities or genetic disorders compared to those with able-bodied conditions (Gonter, 2004). This critique, commonly called the 'expressivist objection,' asserts that technologies like PGD perpetuate and reinforce societal norms that marginalise and devalue individuals with genetic variations. Drawing parallels between racism and disability, Asch (2000) contends that, akin to racism's

focus on a person's physical attributes, PGD concentrates on a singular genetic trait, thereby overlooking the holistic identity of an individual. Offering a personal narrative, Saxton (1984) argues that PGD essentially deems individuals with specific genetic traits as 'unworthy of being alive' by pre-emptively preventing their birth. Saxton further underscores this sentiment through a personal reflection, stating, '*If PGD were available to my parents, I might not be alive today*' (ibid). This troubling account encapsulates the profound insecurities and existential concerns experienced by individuals with disabilities in the era of PGD, thereby problematising aspects of self-esteem and identity development during childhood and adolescence (Grotevant et al. et al., 2000). It is noteworthy that a significant portion of the medical practitioners interviewed for the study tend to frame the reproductive Choice of preimplantation genetic diagnosis as a medical solution to potential disabilities rather than a socially constructed phenomenon. This perspective aligns with the medical model and underscores the prevailing discourse on the perceived medical necessity of PGD within the broader context of reproductive decision-making.

Dr. Naidu said,

PGD is used to identify serious genetic diseases like sickle cell, cystic fibrosis, etc, in the frozen embryo. We are offering this technological solution to those people who need it. This is a costly treatment that everyone cannot afford. Furthermore, most importantly, we do not use this technology to identify disability problems in the embryo. You know, in this state of Andhra and Telangana, most of the people are marrying their cross cousins today. So, there is a high chance that the prospective child might carry serious genetic diseases, if any. Because of this problem, women might be facing recurrent pregnancy failure. So, while looking for the reason for recurrent miscarriage and family history of any serious diseases, if we identify the embryo carrying any genetic disease, we prevent them from transferring. I do not think there is any ethical problem with using PGD. Tell me, who would like to get an embryo transfer knowing she might again experience miscarriage or the prospective child might be born with some disability, i.e., with some serious health problem?

Dr. Naidu's advocacy for utilising Preimplantation Genetic Diagnosis (PGD) technology as a pro-patient measure aligns with a paradigm consistent with the medical model. Within this framework, disability is construed as a medical condition, with the elimination of physical impairment being deemed achievable through technological interventions where deemed necessary. Driven by professional ethics, her endorsement of this technological solution is underpinned by moral values prioritising alleviating disability through medical means. Beyond its implications for individuals with disabilities, PGD technology, as articulated by a majority

of medical practitioners, is perceived as a mechanism that confronts the transmission of existing genetic diseases to successive generations. In a similar vein, Dr Joshi, a genetic specialist affiliated with a prominent fertility centre in the city, contributes to this discourse by stating:

We do not understand the critiques of this technology. Media is unnecessarily creating problems by portraying a bad image of the technology by calling it 'designer baby' or what you call 'eugenic.' We, doctors, are not forcing any patient to do anything. It is the need of patients that we are fulfilling through technology. I have a patient who has gone through seven IVF cycle failures and is carrying a genetic disorder. Imagine her condition. I do not know how the previous doctor where she had her last treatment did not suggest a PGS test. Now, when we checked, she is married to her cross-cousin. Moreover, they might be carrying genetic diseases. So, we directly suggested they go for PGD, which is more advanced than PGS. We are helping them to select the best embryos for them. Every woman coming to the hospital desires to be a mother, and every couple coming to the hospital wants to become a parent. They are spending their hard-earned money on this treatment to have a child. We are just helping them get successfully pregnant. These technological developments like PGD and ICSI are a boon to this treatment.

Genetic specialist, a Ph.D. holder of a university abroad, Dr. Ruchika said,

We practice every technology lawfully and ethically. PGD is legal in India when we use it to identify diseases in pre-implanted embryos. Nowadays, people are aware of the technology. When they failed in their previous clinics, they came here. We help them with advanced technology like PGD. I would not say that people are choosing PGD to identify a disability. This technology is used for selective patients with a family medical history who are mainly married to their cross-cousins. Because in that case, there is a high chance that the embryo might carry the genetic diseases. Firstly, this is a costly technology. People are spending money to take a healthy child home. Furthermore, we are just assisting them in achieving their desired result through advanced medical technologies.

While rejecting the ideal of the 'discriminatory practice' of selective birth that produces an abled-bodied person, Dr L. Reddy said,

PGD and PGS are not regular technologies like IVF, which is used frequently among all patients. When a person's embryos are tested to be abnormal repeatedly, we do not use other technology or treatment to do gene cloning because gene therapy for human reproduction is banned in India. In that case, we suggest the patients for donor treatment. So, PGD is not the end of IVF. Every day, scientists work to make medical technologies to find practical solutions to the problems people encounter.

Evident in the narratives provided by medical practitioners, individual couples engaged in In Vitro Fertilization (IVF) exhibit a discernible inclination towards demanding sex-selective births facilitated by preimplantation genetic techniques. Similarly, the impetus for selective birth through Preimplantation Genetic Diagnosis (PGD) technology emanates from a desire to eliminate embryos carrying genetic disorders, opting instead for ostensibly healthy embryos for the process of conception. Notably, these techniques, integral components of the IVF network, are perceived as contributing to enhancing IVF success rates from a medical standpoint.

Moreover, the considerable financial expense of these supplementary technological interventions in fertility treatment introduces a socioeconomic dimension, creating a scenario where access is constrained to individuals of specific economic classes. Consequently, the IVF network evolves into an inherently unequal space delineated by the socioeconomic standing and class of the users and the moral values of medical practitioners influenced by their professional ethics. Within this network, medical professionals assume the role of 'moral pioneers,' effectively navigating the interests of prospective parents alongside their ethical convictions (Rapp, 1988, 1999, as cited in Shaw, 2019). This underscores the complex interplay of socioeconomic factors, ethical considerations, and the pursuit of reproductive technologies within the broader framework of assisted reproductive practices.

The limitations associated with PGS, PGD and other technological assistance within the IVF network prompt ongoing scientific exploration and innovation within the realm of fertility and reproduction. Current research endeavours strive to enhance the success rates of In Vitro Fertilization (IVF) procedures while concurrently minimising the potential damage induced by biopsy procedures. These scientific pursuits aim to overcome physiological challenges and align with societal demands driven by individuals' aspirations to choose specific traits for their prospective offspring selectively, encompassing characteristics such as physical appearance or intellectual abilities. One innovative technique catering to these desires is somatic cell nuclear transfer (SCNT), a cloning methodology involving the transplantation of a donor nucleus from a somatic cell into an egg cell. It is imperative to acknowledge that the legal restrictions on SCNT are prevalent in various countries, including India, where its application is predominantly limited to medical purposes for treating genetic diseases. Consequently, fertility clinics often resort to alternative methodologies, such as donor conception, to fulfil the

reproductive aspirations of individuals desiring to have children. This delineation underscores the dynamic interplay between scientific advancements, legal frameworks, and societal preferences within the multifaceted landscape of assisted reproductive technologies.

Redefining ‘own child’ by medical practitioners: Designer baby and donor treatment

Restrictions on the use of PGD and related technologies have increased the acceptance and normalisation of donor treatment. In our society, where kinship lineage is primarily traced through the father's side, donor eggs tend to be more acceptable than donor sperm. However, it is essential to note that donor sperm is not entirely unacceptable, although interviews with medical practitioners indicate that it is relatively less favoured than donor eggs. The practice of donor treatment, whether involving donor eggs, sperm, or embryos, is not without biases. Medical practitioners often tailor donor options to align with the preferences and desires of prospective parents. Despite the requirement for donor anonymity in IVF practices, some prospective parents still seek donors based on specific traits like skin colour, religion, or ethnicity, giving rise to what is often called ‘designer babies’ (Franklin, 2013, p.24). With genome editing tools for human reproduction being deemed illegal in India, donor treatment becomes the primary alternative offered by the medical field to prospective parents. Infertility centres frequently provide donor treatment facilities while prioritising the desires and needs of their clients.

However, the notion of an ‘own child’ becomes complex in the context of donor treatment, as it implies a biological link between the child and the parent. This section presents the findings on how medical practitioners navigate the concept of reproductive Choice through donor treatment for prospective parents, considering the intricacies and implications of such choices. Developing and implementing advanced ARTs within the IVF network, such as ICSI, donor treatment, PGD, and PGT-A, have challenged traditional notions of masculinity, femininity, and kinship formation. In contrast to earlier practices, modern IVF with donor treatment now upholds the respective clients’ identity. Donor treatment has become common, with donor eggs being more readily accepted and considered natural in most cases. However, the acceptance of donor insemination is less widespread and is often viewed as unnatural. The resistance to donor insemination is rooted in its potential to disrupt cultural ideals surrounding fatherhood, motherhood, and genetic continuity in our society (Becker, 2000). As a result, many medical professionals emphasise the prevalence of donor egg usage over donor insemination. It is important to note that attitudes toward these practices may vary among ethnic groups. For

women, conception through donor eggs is often deemed as 'natural' because the genetic link of the child is traced through the male lineage. Women's conception is traditionally associated with the bodily experience of becoming pregnant and giving birth (ibid). However, as discussed in the previous section, there are exceptions where both prospective fathers and prospective mothers are open to accepting donor embryos that are not genetically linked to either parent. These evolving attitudes reflect contemporary society's changing reproductive choices and family formation landscape. While stressing the use of donor treatment, MR. Rao (Pseudonym), who is a patient counsellor, legal adviser, and managing director of a famous fertility centre in the city, said,

At least one can have half a baby through donor egg or sperm. People like Sushmita Sen and those living in posh areas can adopt, but it is not meant for lower-class people. Embryo donation is circumventing adoption law. But we are treating patients through embryo donation. Nothing belongs to the couple, but they want their baby immediately without waiting for seven years through the adoption process. The Central Adoption Resource Authority (CARA), the official body regulating adoptions in India, works very slowly. As there are no legal impediments yet, we are helping couples who cannot even produce both egg and sperm of their own. Don't you think this is a miracle? This is possible only through this modern technology. Moreover, we are just mediators between those people and technology, helping that miracle to happen.

In response to their experience with couples from different social backgrounds, Mr. Rao said,

Donor treatment is relatively acceptable by Hindus and other community people and not acceptable in other communities. But nowadays, irrespective of their faith, many couples are choosing IVF. As per my knowledge, some couples also have used donor's gamete. They prefer to go for a donor from their religious background. Normally, we do not inform the prospective parents of the social background of the donors, like the donor's education, caste, and religion. But people keep asking about the details of the donor as they want to confirm the donor's religion, skin colour, and health. But we do not inform them because they will take the baby, and there is no genetic connectivity between the commissioning parents and the prospective child.

It may be observed that couples accept donor treatment with a minimum satisfaction of carrying their 'half baby.' However, this 'half baby' is more likely to be chosen with a genetic link with the prospective father than with the prospective mother to 'maintain genetic continuity (Becker, 2000) from the father's side. Preference for the same religious faith of the donor also suggests that the couple wants the child to carry the religious link.

Dr. Naidu has experienced a gender-biased demand for donor insemination from some of her patients who have demanded that donor insemination be used from their family member, i.e., from the biological brother of the prospective father. In her words,

Doctors and technology do what people want us to do. It is their need and desire that we fulfil. There was a patient of mine who came and requested us to use a donor's sperm and requested us not to inform his wife about it. But we are not supposed to do that. So, we denied it. But these days, IVF centres are mushrooming all around the city. We need to find out who does what. I will give another example from my experience. Long ago, during the 1980s, a couple consulted me. The husband is an IIT (Indian Institute of Technology) pass-out, and the wife is a graduate. In front of his wife, he asked, 'Can we use my brother's sperm?'. Nowadays, everyone wants a 'designer baby.' There are many very peculiar problems. Suppose a man wants a semen donor from his own family. How is that possible? These things are not possible.

According to Dr. Naidu's account, some individuals prefer donor insemination, specifically from a member of their own family. This selective and biased demand from prospective parents reflects the persistence of 'heteropatriarchal ideas,' which seek to maintain kinship links through male genes. Dr. Naidu refers to this desire as an aspiration to create a 'designer baby' by establishing a 'genetic tie' between the male partner and the third-party donor. The significance placed on genetic ties is driven by the wish to uphold blood relations and to pass on self-proclaimed genetic intellectual traits from the male partner. In this context, prospective parents desire to use donor semen to carry their family's intellectual tradition to the next generation, especially if the prospective father and his brother have attended esteemed institutions like IIT.

Part II

Market, media, and state: Constructing choice in the fertility industry

This part of the chapter delves into the intricate dynamics within the fertility industry, exploring the IVF network involving diverse actors such as the state, IVF technology, market, and media. By using narratives from different sources of media reports, government reports, and market information, it is argued here that these non-human actors collectively influence the shaping of IVF technology and the decision-making process regarding reproductive choices. The state and technology mutually reinforce each other's existence within the framework dictated by the market and media. While the state assumes a regulatory role, addressing ethical questions and ontological dilemmas associated with technology, the market and media play crucial roles in its distribution and promotion. Critiques from a determinist standpoint suggest that these non-

human actors wield considerable influence over the users or consumers of IVF technology, effectively shaping their reproductive choices. Such critiques posit that individuals become passive recipients of the “technological enterprise,” wherein their decisions are moulded by the forces at play (Strathern, 1992: a). Consequently, the market and media enhance this technological enterprise through advertisements and technology promotion, perpetuating its hold on reproductive choices. Moreover, the state, according to critics, manipulates and exploits reproductive Choice, especially concerning women's decisions, for its benefit (Gupta, 2002).

Governance/Regulation of assisted reproductive technologies

The Indian state has adopted different regulatory frameworks to protect both the 'epistemic curiosity' of the scientific community and the moral needs of IVF users. Both the scientific and regulatory knowledge around IVF technology is constructed and legalised through the process of 'negotiation,' 'contestation,' and 'translation' (Jasanoff, 1998) between various private and non-private agencies including ethicists, corporate agencies, and many parts including doctors practising ARTs.

Indian Council of Medical Research (ICMR) developed guidelines for using ART, including IVF technology in 1990s. These guidelines helped regulate IVF technology use in the country and ensured that clinics met certain standards. The Indian government also provided financial incentives for the growth of the healthcare sector, including IVF clinics. For example, the government provided tax exemptions for equipment and materials used in IVF clinics, which made it more affordable for clinics to offer these services. Under the new regime of commercialisation and privatisation of medical services, poor Indian women started renting their wombs to carry a child to term, mainly for foreigners using IVF technology by the commissioning parents. Even though foreigners started choosing India as their preferred destination to commission commercial surrogacy, Indians also started practising commercial Surrogacy to have their desired child. India soon became a destination for medical tourism.

The Indian Society of Assistant Reproduction (ISAR) was set up in 1991 by Dr. Mahendra Parikh, a leading obstetrician and gynaecologist. ISAR aimed to promote advancing knowledge about assisted reproductive technology (ART) in India through research, education, and training. It facilitated the exchange of information and expertise among its members. It also aimed to promote ethical and safe practices of ART and to raise awareness about infertility and its management among the general public. ISAR has played a crucial role in establishing

guidelines for ART in India and has collaborated with other national and international organisations to improve the standard of care in this field.

ISAR and the Union Health Ministry set up a registry, named, The National ART Registry of India known NARI in short, in 2001 to regulate ART practices by different fertility centres in India. NARI is an essential constituent of global registries like the International Committee for Monitoring Assisted Reproductive Technologies (ICMART). Despite NARI experiencing an increasing number of fertility centres being registered in this association, counting on an exact account of the IVF practice or commissioning commercial Surrogacy using IVF technology is still being determined as foreigners mostly were doing commercial Surrogacy in India with a tourist visa. The state had no regulations except for the National Guidelines on Accreditation, Supervision, and Regulation of ART Clinics in India. These guidelines were formulated by 'The Indian Council of Medical Research' (ICMR) in 2005. Therefore, these guidelines remained non-statutory and were not justifiable before the court.

A draft of the Assisted Reproductive Technology (Regulation) Bill and Rules proposed by the Ministry of Health and Family Welfare, India, in 2008 after the controversies emerged in the Baby Manji case. Baby Manji Yamada, a child, was born through Surrogacy in India in 2008. The case highlighted the legal complexities and ethical issues surrounding Surrogacy and raised questions about the need for regulation (Indian Kanoon 2008). Baby Manji was born to a Japanese couple through a surrogacy arrangement in India. However, the commissioning parents divorced before the child's birth, and the biological father refused to take custody of the child. The surrogate mother also refused custody of the child, leaving Baby Manji in legal limbo. The case brought attention to the lack of legal clarity around Surrogacy in India and the need for better industry regulation. It also highlighted the potential risks for surrogate mothers, who may not have legal rights to the child or may be exploited by unscrupulous agents. A petition was filed in 2008 in the Supreme Court of India between baby Manji Yamada and the Union of India under the Commission for Protection of Child Rights Act, 2005.

Following the Baby Manji case, the ART Regulation Bill was revised in 2010 and, in 2013, left the decision of commissioning couples or parents in the hands of ART clinics. Indian Council of Medical Research (ICMR) issued surrogacy guidelines in 2012, which included requirements for the medical and legal screening of surrogate mothers and intended parents and a framework for the ethical and legal management of surrogacy agreements. In 2013, the Ministry of Home Affairs, India, made medical visas mandatory for foreigners in case they

intend to commission Gestational Surrogacy. However, concerns about the exploitation of surrogate mothers and the need to regulate the surrogacy industry continued, leading to the introduction of the Surrogacy (Regulation) Bill in 2016. Following the guidelines issued by the government of India in March 2014, Surrogacy Regulation Bill 2016 banned commercial Surrogacy for foreign couples, single parents, and prospective parents from the LGBTQ community. Under this bill, only altruistic Surrogacy was allowed to heterosexual couples married for at least five years and facing difficulties to conceive. Initially the Surrogacy Regulation Bill was introduced in the lower house of Lok Sabha in Parliament in 2016. However, this bill was lapsed with the dissolution of the 16th Lok Sabha at that time. The bill was further introduced as the Surrogacy (Regulation) Bill, 2019 in the 17th Lok Sabha and was subsequently revised and passed by both houses of Parliament in 2020. Surrogacy Regulation Bill 2020 aimed at establishing both the National Surrogacy Board and State Surrogacy Boards to regulate surrogacy practices and ensure the protection of the rights of surrogate mothers and children through Surrogacy. The bill provides a comprehensive legal framework for Surrogacy, including the registration of surrogacy clinics, the eligibility criteria for intended parents, and the rights of surrogate mothers and children.

Though the Surrogacy Regulation Bill 2020 dealt with issues pertaining to assisted reproductive technology and Surrogacy, its primary focus was to prevent the exploitation of women through the commercialisation of Surrogacy and to protect the rights and welfare of the child born through Surrogacy. On the other hand, the Assisted Reproductive Technology (Regulation) Bill 2020 aimed to regulate the broader field of assisted reproductive technology, including the use of technologies such as in-vitro fertilisation (IVF), intracytoplasmic sperm injection (ICSI), and gamete donation, etc. The bill aimed to regulate all aspects of ART clinics and banks, including accreditation, supervision, and regulation.

Subsequently, The Parliamentary Standing Committee on Health and Family Welfare submitted a 129th report on the Assisted Reproductive Technology (Regulation) Bill, 2020, to the Rajya Sabha on 22 January 2021 with valuable insights and recommendations for improvement. The report provided a detailed analysis of the bill, which aimed to regulate the practice of assisted reproductive technologies (ARTs) in India. The report highlighted the importance of regulating the ART sector due to the ethical and legal issues involved, as well as the potential risks to the health and safety of patients. The report discussed the bill's key provisions, such as establishing a national registry of ART clinics and regulating gamete donation and Surrogacy. It also provided recommendations for improving the bill, such as the

need for clear guidelines for screening and selecting donors and surrogates and including provisions for protecting the welfare and rights of children born through ART. The report also discussed the effect of the COVID-19 pandemic on the ART sector and the need for measures to ensure the safety of patients and healthcare workers during ART procedures. Both Assisted Reproductive Technology (regulation) and Surrogacy (regulation) bills were passed in Parliament in early December 2021. Both bills became law on 16 December 2021 and on 25 December 2021. The former act aims to regulate ARTs such as IVF, ICSI, sperm, and egg banks and to control the unethical practice of issues related to sex selection mainly through Pre-genetic diagnosis (PGD), etc.

Surrogacy (Regulation) Act 2021 aimed to establish National and State boards within ninety days of passing of the act. Under this act, commercial Surrogacy is banned entirely, and it allows only altruistic Surrogacy. Altruistic Surrogacy means a surrogate mother needs to be a family member or prospective parent who should be ready to be a surrogate mother with informed consent. However, in a patriarchal society like India, 'informed consent' is problematic for a woman who may give consent under societal pressure. In this context, it is difficult to identify whether it is informed or forced consent. Suppose a woman is pressurised to give consent to become a surrogate for any of her family members or relatives. In that case, this regulation shall work against Article 23 under the Indian Constitution, which prohibits free labour of the body. ARTs, through altruistic surrogacy practice, can perpetuate gender inequalities and re-enforce stereotypes about women's bodies and reproductive capacities, as it is difficult to understand the real consent of a surrogate mother. This act also undervalues women's unpaid labour.

Nevertheless, women's labour, in general, is regarded as free labour in Indian families and women as caregivers. While commercial Surrogacy is banned under the new Surrogacy (regulation), which acts to protect poor women from exploitation and the possibility of forced labour, altruistic Surrogacy, on the other hand, does not answer the solution of forced labour or exploitation of women who may 'choose' to be a surrogate. Despite the new act allowing the practice of altruistic Surrogacy, it has debarred the use of ARTs and the practice of Surrogacy to homosexual couples, single aspiring parents, and the LGBT community. This discriminatory regulation of ARTs by the state shows that the state acts as a 'moral pioneer' who tries to protect the dominant hetero-patriarchal norms of its society.

Like the Surrogacy (regulation) Act 2021, the Assisted Reproductive Technology (Regulation) Act 2021 attempts to regulate ARTs and ART banks that store and restore eggs and gametes used in IVF procedures through State and National ART boards. Under this board, the act put a restricted age of gamete donors between 21 and 55 for males and oocytes between 23 and 35 for females. While the act imposes marital status as a necessary condition for women to donate oocytes, it leaves men free of that restriction. Making marital status for women to donate oocyte the act reinforces the societal norm that women are responsible for giving birth and are the natural caregivers and child-rearers. Further, this act debarred the use of ARTs, including IVF and ICSI, for unmarried single aspiring parents and heterosexual couples even if they are tested infertile medically. This restriction further reinforces and reproduces heteronormative ideology or hetero-patriarchal ideology. In other words, the state prioritised social morality over constitutional morality. On the one hand, this act criminalises the use of PGD during the IVF cycle for sex selection, and it does not specify any mechanism that could identify sex selection through the same technology. Allowing PGD in IVF gives prospective parents more choices, but it defines disability as abnormal.

The Acts under discussion are not neutral but influenced by societal values and ideologies. They significantly impact both ART (Assisted Reproductive Technologies) and society by controlling the use of technology and perpetuating gender-based patriarchal norms deeply rooted in Indian society. The prevailing socio-cultural and moral values heavily influence ART practices, reducing the state's regulatory role. Through these Acts, the state acts as a regulatory actor by reinforcing social morality related to IVF and ARTs, setting standards and guidelines that align with commonly held social values and ethical principles (The ART (Regulation) Act 2021 and the Surrogacy (Regulation) Act 2021, by restricting ARTs and Surrogacy to only married heterosexual couples, reinforce the notion of a 'heteropatriarchal family' as the norm and morally acceptable value (Nadimpally et al., 2016). This exclusionary approach marginalises other family structures, such as LGBTQ couples and single parents, denying them access to ARTs and Surrogacy. As a result, the state fails to uphold "constitutional morality" that promotes equality and human rights, disregarding the underlying principles of the Constitution and the rule of law. Instead, the state prioritises social morality, perpetuating unequal treatment and discrimination against certain individuals and communities.

Market shaping approach intersecting with hetero-patriarchal ideology

The commercialisation of IVF technology and expansion of the fertility market corresponded with the industrialisation and corporatisation of health care in India in the post-economic liberalisation period (Jeffery, 1988). While the state remained engaged in making regulations on ARTs, the IVF market expanded itself mostly in the form of the (commercial) surrogacy industry. The country attracted the practice of much transnational commercial Surrogacy, making the city of Anand a 'surrogacy capital.'²⁴ that used the newly developed IVF technology at its maximum. However, it is difficult to identify the exact amount of profit this industry has made due to the lack of regulation and no specific study that measured the market. However, a study conducted by the UN in July 2012 estimated that the surrogacy business has expanded to more than USD 400 million a year, with over three thousand fertility clinics across India (Bhalla et al., 2013). Recently, the Indian State finally banned 'commercial surrogacy' after two decades of a long legislative battle to regulate the industry. Nevertheless, the ART industry succeeded in establishing itself in the Indian market, which generated \$12,505 million in profit in 2018 and is estimated to reach \$26,376 million by 2026 (Surabhi P, Onkar S. 2019). Another study shows that IVF technology earned a profit of \$793.27 million in 2020 and is projected to reach 3,721.99 million by 2030 (Vishal et al., 2022).

The fertility industry relies heavily on the market as a crucial intermediary between medical practitioners and prospective parents seeking IVF technology. In this market, the dynamics of supply and demand drive the exchange of fertility services, with a focus on profit-making. The utilitarian perspective of the market emphasises maximising good outcomes for the majority, often overlooking broader social, political, and ethical considerations. Critics, especially scholars in Science and Technology Studies (STS), challenge this utilitarian view, arguing that the market is not solely governed by its internal logic. Instead, they assert that the market operates in conjunction with various social, technical, legal, and regulatory aspects as part of its strategy to function in society. Viewing the fertility market more holistically, STS scholars see it as a complex system of technologies and institutions that integrate socio-cultural values, shaping the functioning of the market like a "cultural device" (Callon, 1998, p.7).

Over the years, the IVF market in India has undergone significant transformations, closely mirroring the shifts in the country's economic landscape—from a socialist economy to a mixed

²⁴ The city of Anand, Gujarat, India, was popularised by the media as a 'surrogacy capital' in the early 2000s. This city became well-known for providing surrogacy services to couples across the world. For details, see Sharma Radha (2008) '*Anand back in focus as surrogacy capital*', Times of India.

economy and, more recently, to a more capitalist market. In this dynamic market, IVF technology interacts with human and non-human elements, material and non-material. These elements include technology, regulatory institutions, legal frameworks, societal norms, and values. Initially, the IVF market in India faced challenges such as the high cost of technology, limited regulation, the social stigma surrounding artificial birth methods versus natural birth, misinformation, and lack of awareness. Early on, IVF technology was predominantly utilised for commercial Surrogacy. However, with the recent ban on commercial Surrogacy, the focus of the IVF market has shifted towards the practice of IVF itself, emphasising improving success rates through advancements in Assisted Reproductive Technologies (ARTs). As the IVF market evolves, it has overcome some of the social barriers it encountered in its early days. There is now increased acceptance of using donor eggs and sperm. While many IVF users still prefer to keep their treatments private within their immediate family, the stigma associated with technological assistance has significantly reduced. This growing IVF market reflects a growing acceptance and understanding of IVF technology and its potential benefits in fulfilling the desire for parenthood.

Social norms and values deeply influence the IVF market as it operates within the framework of broader social institutions and relations, leading to the emergence of what can be called a 'market society' (Polanyi, 2001). In this context, the IVF market employs various strategies and approaches derived from society to make this technology accessible to users within the 'birth market' (Sarojini et al., 2011). This birth market utilises social norms and rules that place immense value on motherhood. Consequently, IVF market advertisements often glorify motherhood and present technological solutions to address the 'biological lack' experienced by so-called infertile mothers in our society. During the fieldwork, the researcher came across an advertisement poster on the digital television of a metro train that glorified motherhood, stating *motherhood completes womanhood. And we help you achieve this long-desired goal.* Another hospital TV advertisement depicted, *'Not yet a mother? Make us your partner on your journey to successfully achieve your dream of becoming a mother.'* These advertisements appeal to the 'parental desire' (Strathern, 1992), framing it as a 'natural' aspiration in the context of the 'enterprise culture' to promote the use of IVF technology (Bharadwaj, 2016). This parental desire is deeply rooted in historically shaped socio-cultural values associated with motherhood and the pursuit of parenthood.

IVF market is not free from social norms and values as the market is embedded within broader social institutions and relations, leading to a new form of society, i.e., 'market society' (Polanyi,

2001). It is observed from the field that the IVF market embeds multiple strategies or approaches derived from society to bring this technology to reach its users in the 'birth market' (Sarojini et al., 2011). This birth market uses social norms and rules that embed the highest values in motherhood. Therefore, IVF market use through advertisement glorifies motherhood and claims to provide a technological solution to the 'biological lack' that the so-called infertile mother experiences in our society. I observed an advertisement poster glorifying motherhood on the digital television of the metro train while travelling to my field site. The flashing advertisement of an IVF centre depicts *motherhood completes womanhood. And we help you to achieve this long-desired goal.* Another advertisement on the hospital TV portrayed, *'Not yet a mother? Make us partners on your journey to successfully achieve your motherhood dream.'* The 'parental desire' (Strathern, 1992) is used by market strategy as a 'natural' desire in the 'enterprise culture' to operationalise IVF technology (Bharadwaj, 2016). Additionally, parental desire is embedded within the historically shaped socio-cultural values of motherhood and achieving parenthood.

The IVF market incorporates social norms into its marketing strategy and normalises the use of donor eggs and sperm, shaping the perception of the traditional family structure. An advertisement observed on the field site for an IVF centre conveyed the message, *'Donate egg/sperm and help someone achieve parenthood,'* highlighting the normalisation and naturalisation of donor genetic material as a noble act free from the rational market principle. This normalisation of donor genetic material happens in the everyday interaction of doctors and so-called patients, including the counselling process, where professional counsellors make prospective parents aware of the importance of using donor genetic material. However, it is also observed from the field site that many respondent parents accept the donor option and negotiate the use and price of this additional cost with hospital staff: a medical practitioner and an aspiring IVF couple normalised donor treatment in their interaction in IVF centres. The conversation between a doctor and prospective parents seeking donor treatment within IVF is presented below. It is observed from the field that medical practitioners emphasise a woman's interest and opinion on treatment options during counselling. While explaining the IVF procedure, a couple of doctors started explaining the IVF procedure as follows,

Have you got your semen analysis test done? (said, pointing out to the Man and without waiting for a response, the doctor continued) We either mix the donor's egg with your husband's sperm (said while looking at the woman). Otherwise, we take a donor embryo, readymade from outside, i.e., someone's egg and sperm. We first do the complete medical check-up of donors. If every test comes out fine, we will do her follicular scan and check

her egg. We choose a donor who has already given birth or is already in childbearing age from 20 to 25. We give an injection on the second day of her (donors') periods, and in between ten days, we do a follicular scan, and then we will extract her egg in fifteen days. Further, we take sperm from your husband, mix that with the donor's egg, and keep it in the lab for five days to grow. After five days, the embryo is to be inserted into the uterus.

Doctors noticed her low haemoglobin while looking at the woman's medical reports. The doctor kept explaining the IVF procedure while emphasising the donor option as the woman (prospective mother's pseudonym Smiti) was not able to understand the scientific procedure involved in IVF. In this explanation, the doctor repeatedly asks the couple to choose either a donor egg or an embryo. It is also observed during the conversation that the Man (Smiti's husband) was concerned about the financial cost of the treatment, Smiti repeatedly emphasising giving birth to a child at any cost, i.e., with all financial burden and with both donor egg or sperm or with donor embryos. Smiti said while responding to the doctor after a few minutes of silence.

I do not understand all the complicacies, but I want a baby by either means. Which option is good for me, donor egg or donor embryo?

While responding to Smiti's curiosity, the doctor elaborated upon the importance of half-gene and having a child without a genetic connection to the child using donor embryos, which, according to the doctor, is an easy and less invasive procedure. Doctor said,

Any of the two options are good. Before the procedure, you should go for your husband's sperm check-up. If he has healthy sperm, you can go with the donor's egg and your husband's sperm. Otherwise, donor embryos are a little easier, as we do not have to do egg and sperm extraction and embryo formation. Donor embryo is an easy IVF method because it is readymade. But it would be best to choose whether you want your half-gene or you are fine with no gene connection.

While interrupting Smiti told the doctor,

Agar bacha hota hai to hum ready hai kaise bhi. (We are ready for either option if this treatment delivers a baby).

It may be inferred that giving birth through donor treatment, even without a genetic link to the child, has become commonplace in IVF treatment. People widely accept this practice and extensively promote it in the market. Thus, the IVF market aligns with existing social norms and shapes and redefines family structures in the technological age. Despite the normalisation of donor treatment, the recent Assisted Reproductive Technologies Act 2021 in India has

facilitated the commercialisation of donor eggs and sperm by offering limited healthcare access and medical insurance facilities to donors for a specific period. However, most hospitals do not openly discuss payment for donor services. This aspect of unpaid or free donor facilities in the IVF market raises ethical and moral practices, and it raises questions about IVF treatment and the issue of inequality. Sales of body parts are prohibited under the Act 'Transplantation of Human Organs and Tissues', which came in 1994. Meanwhile, article 14 of the Indian Constitution prohibits free labour through the body. Contrary to this, the Indian Act globalised market has influenced individual 'reproductive choices' by commodifying body tissues, where body parts like donor genetic materials are exchanged, priced, sold, and purchased (Unnithan, 2010). As discussed here, body parts like donor gametes and oocytes are considered a 'moral act,' which raises concerns about the ethical practice and economic values of donor genetic material within the IVF method as these body parts are not intended to be produced for sale according to state laws.

In order to ensure its successful functioning, the ART market seeks widespread acceptance and support from various stakeholders, including medical practitioners, the state, the media, and prospective parents. While profit-making is a significant goal, the market also incorporates and reinforces heteronormative and hetero-patriarchal ideologies to legitimise IVF technology. This intersection between the ART market and patriarchal values in society places immense pressure on women to achieve motherhood, leading to societal stigmas and discriminatory actions if they fail to do so. Women facing societal pressures undergo multiple IVF cycles, sacrificing their health in the pursuit of motherhood. They may even opt for donor eggs to conceive. At the same time, the acceptance of sperm donation remains limited due to the prevailing emphasis on male genetic ties in kinship formation, perpetuated by the patriarchal ideology. In chapter four it is already discussed how women prioritise the experience of conception through IVF and donor treatment. However, this emphasis coexists with the dominant hetero-patriarchal ideology prevalent in society. Medical practitioners use this ideology to create a market for IVF and related technologies, aligning reproductive choices with societal expectations. Incorporating these social needs into the market strategy challenges the notion of the market as an independent actor, operating beyond the influence of society and highlighting how the market and society intersect. Ultimately, the market's primary objective is to make a profit, but its functioning is deeply intertwined with societal values and technological advancements.

Media's role in shaping IVF technology: Hope, credibility, and ambiguity

Media is a key actor that played a role as a powerful 'rhetorical device' of the twentieth century and as a form of 'institutional advertisement.' Mass media is an important actor in the IVF network, contributing to scientific and technological knowledge production (Bharadwaj, A. 2000, 2016). In Indian IVF history, the media acted as the medium that accelerated the issue of the scientific credibility of IVF technology. Due to the lack of this credibility, Dr. Subhas Mukerji (pioneer of Indian IVF babies) took his own life. It was later that he was rewarded post-humously. Later, Dr. Indira Hinduja, the pioneer of IVF technology with whose effort, India got its first scientifically documented test-tube baby. Dr. Hinduja from a Bombay based public hospital had generated research on IVF in collaboration with Dr. Anand Kumar from the Institute for Research in Reproduction (present-day ICMR) in Bombay. This collaborative work received its credibility as India's first successful discovery in IVF fertilisation in the media and the scientific community circle. Eventually, the media helped establish the IVF market. They legitimised IVF technology by narrating infertility and proliferating the progressive and beneficial face of the techno-scientific knowledge of IVF technology and its practitioners. As an actor of rhetorical devices, media has also helped make 'invisible the political contractedness of this technology' (ibid).

Nowadays, different media outlets shape prospective parents' reproductive choices. Those media involve the conventional media, i.e., television, newspaper, and magazines; social media like Facebook, Instagram, Twitter, and YouTube; online forums and support groups often recommended by IVF clinics provide a platform for prospective parents to get support from others undergoing IVF treatment; and podcast, a popular media is used for discussing infertility and IVF treatment. These media outlets disseminate information about IVF technology, its use, and its risks. Corporate stakeholders commercially use this knowledge as a market strategy for their profit (Raymond, 1995). Like other actors, such as the state and market, media is not distanced from society and social values as they are embedded in the everyday practice of IVF technology. The success stories of celebrities on social media and couples who have successfully given birth through IVF portray these technologies as 'hope technology' (Franklin, 2006, p.549). This 'hope technology' is a process of embodied investment in specific cultural values, like scientific progress, that produces an ambivalent coherence to achieve desired parenthood or motherhood. A poster on the hospital wall portrays a picture of a pregnant woman holding her womb with a line that says,

'Turn your parenthood dream into a reality with IVF technology, where advanced technology meets compassionate care. Our trained professionals are dedicated to helping you overcome infertility challenges and fulfil your desire for a family. Trust us to guide you toward hope, happiness, and parenthood. Contact us now to start your IVF journey with us.'

Besides media serving as a platform for commercial advertisement, it also masks and unmasks exploitation and commodification of the body through IVF technology and its practice, as is observed from the field. Most media advertisements depict the optimistic hope IVF and related technologies bring to an aspiring parent struggling to become a parent. On the other hand, hardly any media (mainly commercial ones) is open about the possible side effects and risks this technology brings to the human body, mainly to women's bodies. However, the shared experiences of women or couples who have undergone infertility treatment through IVF technology normalise IVF treatment and rarely does any media discuss or portray the same treatment's risk factor.

Discussion

This chapter has delved into the intricate interplay of four prominent actors within the context of IVF technology: medical institutions, the state, the market, and the media. These actors cannot be regarded as neutral entities; instead, they are deeply intertwined and mutually shaping each other within a societal framework already imbued with social values. Medical institutions, comprising a diverse range of practitioners, are pivotal in constructing "reproductive choices" for individuals. IVF, labelled as a "hope technology," is their medical solution to infertility, fulfilling the societal desire for parenthood. However, this medical intervention is not devoid of social influences, as it perpetuates gender norms and ideals of kinship and marriage. Medical practitioners, seen as "moral pioneers," wield significant influence in shaping the choices of prospective parents, drawing upon a combination of medical epistemology and societal values.

The regulation of ARTs involves intricate negotiations between various agencies, including the state, corporate entities, ethicists, and society. This negotiation occurs in a network relation where each exercises their agency concerning the network. The Indian state's role in ART regulation is multifaceted, having transitioned from an authoritarian stance to that of a moral pioneer, aiming to safeguard capitalist interests while institutionalising social and moral norms in the practice of ARTs. Despite permitting the growth of the ARTs market, the state has imposed limitations on its usage, restricting access to married heterosexual couples and

disallowing single parents, homosexuals, and other genders. This emphasis on "social morality" has sometimes undermined principles of constitutional morality and equal rights. While operating in collaboration, the market collaborates with other actors, such as technology, the state, medical institutions, and the media, to function effectively. It seeks consensus and support from these entities to proliferate IVF technology and normalise its use. The media played a dual role as a rhetorical device and an institutional advertisement, influencing the IVF network and its relationship with other actors. It aids the market in disseminating IVF technology, presenting it as a positive and hopeful solution while downplaying the potential risks and ethical considerations. This portrayal contributes to normalising the use of IVF in society.

All four actors – medical institutions, the state, the market, and the media – cannot be viewed as impartial and apolitical entities. Instead, they operate within a socioeconomic structure influenced by local moral and social values. Through the practice of IVF technology, these actors perpetuate and reshape societal norms and values in a new form. The IVF network is a complex web of interactions between medical institutions, the state, the market, and the media, each influenced by societal values and norms. This intricate interplay raises moral and ethical questions, as it can perpetuate inequality and limit reproductive choices for specific individuals and communities. Addressing these challenges requires a critical examination of the roles played by each actor and a commitment to promote a more equitable, inclusive, and ethically responsible approach to assisted reproductive technologies. Only through a comprehensive understanding of these complexities and a conscious effort to promote fairness and equal rights can we navigate the ethical landscape of the IVF network and ensure that reproductive choices are genuinely empowering and accessible to all.

CHAPTER SEVEN

EPILOGUE

SOCIO-TECHNICAL ENSEMBLE OF IVF: ANALYSING NEGOTIATED AGENCY IN A NETWORK RELATION

“If technoscience may be described as so powerful and yet so small, so concentrated, and so dilute, it means it has the characteristics of a network. The word network indicates that resources are concentrated in a few places-the, knots and the, nodes-which are connected with one another-the links and the mesh: these connections transform the scattered resources into a net that may seem to extend everywhere” (Latour, 1987, p. 181).

The thesis attempted a sociological analysis of IVF in practice, relying heavily on STS scholarship. It delves into the social aspects of IVF. The research journey commenced with a comprehensive exploration of key theoretical constructs and conceptual framework of STS developed by scholars like Bruno Latour, John Law, Michel Callon, Donna Haraway, Sheila Jasanoff, Langdon Winner, and Judy Wajcman, to mention some here. STS scholarship was pivotal in shaping the sociological analysis of science and technological developments and their loci in society. According to Jasanoff (2010), STS is a relatively recent interdisciplinary field that focuses on questions that often need to be addressed within traditional disciplines, like sociology, political science, and economics.

STS emphasises the inseparable relationship between science, technology, and societal structures and practices, as highlighted by Harald Rohrer (2015). Building upon this foundation of STS scholarship, the researcher conducted a thorough review of works in the broader realm of Assisted Reproductive Technologies (ARTs). This entailed an examination of scholarly literature on IVF, employing a formal discourse analysis approach, with particular attention to feminist critiques and empirical studies conducted by social science scholars, including those in sociology, anthropology, economics, humanities, and management disciplines.

Though existing literature on ARTs in general and particularly on IVF provides a thorough academic knowledge background to understand the use and implications of the technology in the various facets of society, it leaves researchers with many gaps that could be studied further. The feminist critique of ARTs, mainly under the 'Feminist International Network of Resistance to Reproductive and Genetic Engineering called (FINRRAGE)', discusses perspectives of

middle-class white women residing in affluent regions of the global north, with few focusing on the South Asian women that leave the reality of women unanswered. It is found from the cultural studies of ARTs (Franklin, 1997, 1996, 2001; Denny, 1994; Rapp, 2011; Sandelowski 1988, 1990, 1990a, & 1994; Strathern, 1992, & 1996) that these scholars constrained their examination within less complex societal contexts and emphasised the implication of ARTs on the institutional structure mainly on family and kinship. Studies in the global north probed the intricate connections between these technologies, the global economy, political landscapes, and the social implications. Studies conducted in the Euro-American and other developed countries advocated for equal distribution of technological access within countries that promote pro-natal policies (Stuhmcke et al., 2020; Weissman and colleagues, 2000, Marken 2012 and Shurr, et al., 2018; Becker et al., 2006). Studies conducted in non-western countries, including India, have predominantly delved into the intricate social landscape of surrogacy, kinship relation, and family (Pande, 2014; Ryan, 2009; Inhorn 2006a, b; Gupta 2000, 2012; Gupta & Richter 2008, Sarojini, Marwah, & Shenoi, 2011; Dasgupta, 2010; Sengupta, 2018; Sengupta et al., 2005; Rudrappa, 2015; Bharadwaj 2016a, b; Majumdar 2017). Studies concerning men or masculinity have remained conspicuously absent within most social investigations, and few focus only on Western developed societies (Becker et al., 2006 & 1986) and Middle Eastern countries (Inhorn, 2009 & 2006; Inhorn & Wentzell 2011). Studies by Chopra (2006), Chopra et al., (2004), and Srivastava (2004) contributed only to the study of men's labour, or they engaged only in theoretical explorations of masculinity in India, which leaves men's reproductive role unexplored, particularly in the aftermath of ARTs.

This background has enabled the study's conceptualisation, which aims to investigate the nature of the relationships among various actors within the IVF network, utilising a field-based ethnographic methodology. In line with the conceptual understanding of Science and Technology Studies (STS), this study adopts the perspective that views technology as an 'ensemble' or entanglement within the broader societal context. Following Bruno Latour's perspective, it is asserted that society and technology should not be perceived as fundamentally distinct entities; instead, they represent different facets of the same underlying process. In Latour's words, '*society and technology are not two ontologically distinct entities but more like phases of the same essential action*' (Latour, 1990a, p. 129). Similarly, it becomes apparent from the literature that a common theme underpinning the interactions within IVF networks revolves around the notion of "choice" or, more specifically, "reproductive choice." This concept of reproductive choice emerges as a variable through which pertinent research

questions are formulated, subsequently informing the development of an unstructured interview schedule.

The research design incorporated a deliberate strategy of open-ended questioning, allowing respondents to construct meaning from their unique experiences. While interviews adhered to an unstructured interview schedule, the fluid nature of the conversations led to the inclusion of new questions in response to the insights provided by the respondents. Furthermore, it is pertinent to note that distinct sets of inquiries were directed toward different categories of respondents. Specifically, the line of questioning for prospective mothers deviated slightly from that for prospective fathers, keeping their divergent gender roles and varying degrees of involvement in the IVF treatment process into consideration. Similarly, respondent doctors specialising in IVF services, paramedical staff, and other personnel within fertility centres were subject to specialised questions, reflecting their roles and responsibilities within the medical domain and considerations related to gender and medical specialisation. In addition to interviews, the research also incorporated the value of ethnographic observations conducted within hospitals, marketing sites, and advertisements used through diverse media platforms. Concurrently, the researcher engaged in informal dialogues with all respondents to supplement the structured interview data. While the primary locus of data collection and ethnographic observation remained concentrated within the two selected hospitals, many interviews were conducted with doctors from other fertility centres. This approach was instrumental in comprehensively understanding diverse perspectives among doctors engaged in IVF practice.

Furthermore, supplementary data about the roles of the state, market forces, and media were collected from governmental and non-governmental documents and various online sources. The data collection phase extended over eighteen months, the specifics of which are elaborated upon in Chapter Two. A systematic approach was employed to analyse all recorded data. This process involved transcription, followed by the development of codes and subsequent organisation into thematic categories. The methodology adhered to a six-step procedure, as articulated by Braun and Clarke in their Reflexive Thematic Analysis (RTA) framework.

All developed themes were strategically structured to form the basis for the subsequent chapters organised according to distinct actors within the research framework. It is pertinent to note that the categorisation of actors was not contingent upon their perceived importance within the research. Therefore, the study refrained from designating any specific vital respondents. Consequently, the chapters following the second chapter are structured around the depiction of ‘actors’, a systematic approach borrowed from the theoretical underpinning of actor-network

theory (ANT) that addresses research inquiries in an organised and coherent manner. In anticipation of the forthcoming chapter on field data, chapter three delved into the evolutionary trajectory of IVF technology within the philosophical, scientific, and historical discourse of developmental biology.

Paradigm shift in developmental biology

To gain insight into the socio-structural context within which Assisted Reproductive Technologies (ARTs), including IVF, have evolved, researchers elaborately discussed a pivotal debate about the origin of life, chiefly situated within the realm of developmental biology. Debate on the ontology of life. This discourse is primarily based on two contradictory but mutually inclusive concepts or ideas: preformationism and epigenesis. Preformationism posits that embryos or individuals preexist in a miniature form within either the mother's egg or the father's sperm, initiating growth upon stimulation. Conversely, epigenesis advances an alternative perspective, contending that an embryo originates from an undifferentiated mass, gradually evolving as new components are incorporated during its developmental trajectory, ultimately culminating in the formation of an individual. These two approaches paved the way for the entire debate on the ontology of life, starting from the macroscopic era to the microscopic era in the seventeenth century, the rise of spermism in the early eighteenth century, and rise of ovism in the later period of the eighteenth century along with the rise of German idealism during the time, to rising empirical methods of scientific inquiry, development of cell theory, in the nineteenth century, to the genetic and molecular revolution and development of engineering technology in the twentieth century and later.

It is observed from the discourse that experimental limitations in the sixteenth and seventeenth centuries prevented extensive research on mammals until the nineteenth century. As a result, most scientific epistemology of that time believed in totalitarian principles, as the Pythagorean and Aristotelian philosophies heavily influenced this knowledge. They believed that life or organisms originate from that invisible totalitarian entity mainly found in men's bodies. Eventually, subsequent theories shifted their attention towards vital entities and later to rationalist and empirical approaches. During the eighteenth century, these ideas, lately called the 'spermism ideal', failed to justify their physiological explanation of life formation. The rising regeneration theory and epigenesis during this time gave little importance to understanding women's contribution to life formation. Eventually, preformationists shifted their understanding from the existence of some vitalist entity and took a materialist position. This new position that preformationism took emphasised the regeneration of genes.

Preformationism, however, failed to prove the visible occurrence of regeneration because Abraham Trembly and Bonnet (the proponents of material preformationism) aimed to develop an organic preformation profile to oppose mechanist epigenesis rather than creating a scientific account of regeneration. With the fall of preformationism, epigenesis started to rise in the eighteenth century from the work of Casper Friedrich Wolff. While being heavily influenced by the natural philosophy of Spinoza, Wolff proposed the idea of vital essentialism from which life began. Later, Wolff explained life's gradual development mechanically, which influenced the nineteenth-century teleological epigenesis. In the nineteenth century, a teleological understanding of epigenesis emerged that moved its emphasis on the origin of life from transcendentalism to mechanical empiricism. The teleological account was supported by the philosopher Emmanuel Kant, who borrowed the concept of 'Bildungstrieb' (natural force) from his contemporary 'Blumenbach', from which, according to him, an organism begins to grow. Bildungstrieb became a methodological tool for German naturalists and physiologists in the nineteenth century, who studied the inherent organic process rather than unfolding the preexisting organic forms. Following Darwinian evolutionary principles, epigenesis theory became close to evolution theory. In the nineteenth century, vitalism was criticised as 'radical anti-reductionism' (Duchesneau, 1985, p. 259). The rise of the materialist approach and the increase of the neo-Kantian approach paved the way for more empirical studies of embryos during this time.

Due to advancements in science, German ideology started losing ground. Wilhelm Roux's experiment held the environment responsible for starting life. The nineteenth century saw a significant paradigm shift in the scientific inquiry of embryonic development. The scientific inquiry emphasises discovering which material things determine life. The agency shifted from mere speculation on vitalism to a more materialist form that can be observed, experimented, and modified. These changes occurred mainly through the contribution of scientists and scientific discoveries like German physiologist Jacques Loeb Ernest Everett, the development of cell theory, Boveri's observation of chromosomes and nucleus, Wilson's cell lineage, Morgan's regeneration, Spemann's transplantation, and Harrison's experiment on tissue culture, James Watson and Francis Crick's DNA discovery. The study of genetic factors diversified, and gene study started recognising nonmendelian cytoplasmic inheritance (in contributing to organism formation. In 1940, Conrad Hal Waddington developed a synthesis approach between gene centrism and a process-centred developmental approach. To this synthesis, Waddington coined the term 'epigenetic.' Waddington's 'epigenetic' merged preformationism and

epigenesis into each other. This synthesis helped scientists of the twentieth century to understand and, therefore, construct life or embryos outside of a human body in vitro. Robert Edward, a Waddington student, could finally create life "in Vitro, known as in vitro fertilisation (IVF), along with the technological support of British physician Patrick Steptoe, after multiple cycles of egg culture failure. A thorough examination of the ontology of life from an understanding of 'paradigm shifts' within the latterly called developmental biology revealed that scientific epistemology and innovations are an amalgamation of science, moral values, societal expectations, faith, personal beliefs, and philosophical ideas dominated in the specific period.

Negotiated agency: Women's experience in IVF network

Following the history of life formation and the development of IVF and other ARTs, the researcher began to analyse the technological appropriation of IVF in the field. To examine its contemporary appropriateness in a society like India, the researcher compiled the qualitative data gathered from the field and developed codes and themes drawing inspiration from the broader research area of science and technology studies (STS). The research borrowed theoretical concepts from Actor-Network Theory (ANT), which recognises the existence of agency among all actors in a network relationship. Drawing on theoretical understanding from science and technology studies in general and actor-network theory, researchers divided chapters based on the role and function of actors.

The first field data chapter elaborately discussed the lived experience of women undergoing IVF using a feminist lens. As it is found from the feminist and academic discourse on IVF, the question of agency became important in the context of the fast medicalisation of reproduction, particularly on women's bodies. The primary concern of this discourse was to explore who possesses the authority and capability to initiate life, under what circumstances, and in what manner. The study included actors like prospective mothers and fathers, medical institutes, the market, and states shaping IVF technology. The central point of inquiry was to explore how women experience, make choices, and meet expectations in the IVF network.

IVF, as an assisted reproductive technology, was developed out of both scientific curiosity and the eagerness of women to have babies in the twentieth century (Maienschein, 2014, p.140). The IVF technology was developed to assist in conception for women with fallopian tube blockage or tubal damage problems. It is observed in the study that the present-day IVF practice incorporates many other ARTs and biomedicines like Preimplantation genetic diagnosis

(PGD), advanced forms of hormonal injections, intracytoplasmic sperm injection (ICSI, for male infertility), etc., which makes IVF an advanced assisted reproductive treatment option. Despite the IVF network incorporating treatment options for male infertility through advanced technologies like ICSI, this medical option largely remains women-centric as it is the women on whose body all this medicine and technologies are directly applied, and it is the women who carry the baby and give birth.

Contrary to the generalised and universalistic definition of women's reproductive rights suggested by feminist ARTs critiques, this study explores women's choices in their local and contextual settings. Therefore, women's reproductive choices and experiences are recorded from the specific context of Hyderabad city, India. The principal objective was to study women's engagement at various stages of the IVF treatment process using narratives from their lived experiences. Women gained increased access to IVF technology due to its easy availability in the capitalist market. In the twenty-first century, the creation of life is no longer restricted only to women's biological bodies. Life can be manufactured within laboratories using IVF technology, and its making is commodified for capitalists' profit. In this emerging consumerist culture, life can be engineered to suit individuals' preferences and time. This method of constructing life through IVF technology provides choices to involuntary childless women. However, despite having technology choices, conception through natural pregnancy remains the first preference for women of all socioeconomic backgrounds. The study also observed that in the absence of no choice, IVF allows women to negotiate with technology and society to create their own identity. Women who chose IVF for motherhood identity are mainly economically dependent and hardly live with any social support. Some of the respondents have shared their IVF experiences, even using donor eggs or sperm in their early twenties without proper informed consent. This practice of IVF raises many ethical questions on the use of IVF technology. Due to the complexity of the IVF practice, its consequences cannot be measured from the dualism of profit or loss for women choosing IVF.

It is observed in the study that even though reproductive choices in IVF networks are not constant, they are complex, where prospective couples, mostly women, make multiple choices at different stages of the treatment process. The initial choices made by women to start IVF for conception are marked by 'hope,' certainty, and sometimes through constraint. However, as women continued their IVF journey, their choices became more uncertain and challenging. Despite experiencing a tremendous amount of physical pain and emotional suffering, women choose to continue IVF. The physical pain and emotional suffering is not discussed in the work

as two binary entity. Instead, pain, as discussed in this study, is an embodied experience women encounter during their conception journey. However, the choices of women within the IVF process vary according to their socioeconomic position. It is found from the study that women from the lower middle class, those who are economically dependent on their spouse and living a life with almost no social support, perceive motherhood as an identity and symbol of self-worth. As coming from their narratives, these women experience high social stigmas in terms of verbal abuse and social isolation. Infertile women are prohibited from attending holy activities or festivals like marriage *seemantham* (baby shower), or they distance themselves from those activities.

In the absence of absolute power, women of low social class prepare themselves to any extent to gain informal power through achieving motherhood with the assistance of technology. They sacrifice their health by undergoing repeated IVF cycles from seven to eight and more. They sell out the assets that they have as a form of dowry during their marriage. Like motherhood, these sacrifices are social expectations that a woman is expected to fulfil as she is held responsible for not being able to give birth to family offspring at an ideal 'reproductive age,' i.e., within one or two years of their marriage. Along with the women, it is found that the natal family is also held responsible for bearing the blame and financial burden of infertility treatment. This is not to say that motherhood identity does not matter to upper caste and class women or women engaged in painful jobs. The study finds that women who hail from the upper or upper middle class (primarily working women) with relatively more social support are experiencing relatively less stigma associated with it. For those women, achieving motherhood is more than an 'identity issue.'

Unlike a mechanical view of infertility, as it is often found in the work of feminist scholars like Karen Throsby (2004), in this study, it is found that women make a moral choice to adopt IVF as an assisted reproductive technology in their conception journey. The desire to 'embody experience' and a 'moral necessity' shape their choices rather than a mechanical one (Throsby, 2004). By calling conception with technological assistance a moral necessity, women exercise what Saba Mahood calls 'moral agency' (Mahmood, 2006). This is a form of agency where ethics, rather than rights, decide the politics of reproduction and reproductive choice, mainly for women in this context. Motherhood as an embodied experience challenges the cartesian approach of body-mind dualism. In the IVF procedure, the woman's body is an active and conscious agent continuously engaging in meaningful experiences. This experience is physical

and emotional, called in social science ‘lived experience’ or what the Medical Anthropologist Margaret M. Lock calls ‘the mindful body’ (M. Lock in Scheper-Hughes, & Lock, 1987).

Further, this technological assistance becomes complex when women make choices about donor treatment. It is found from the narrative of women that their social class and social support determine their donor choices. Women with no or poor social support or those who are financially dependent on their husbands and family experience a constrained choice for donor treatment in particular and IVF in general. Most of the time, these women lack the agency to decide on their bodies. However, it is also observed that over time, upon gaining social and economic support, women learn to oppose IVF, mainly for the second child. However, apart from constraint choice, many choose IVF even in the case of male infertility, and they use donor sperm if needed to keep their marriage relationship safe because divorce and separation are not an option for many middle-class Indian women. Besides, women who have strong relationships with their partners choose donor treatment out of love and moral responsibility for their partners. It is also found in this study that the use of donor sperm as a ‘secret option’ gives some agency to women to negotiate within the marital relationship, mainly if they were blamed and abused before their husband was tested infertile medically. Though donor egg is also considered a stigma, it is relatively acceptable by many than donor sperm. Women's socioeconomic and family position further determines the acceptance of donor eggs. However, it is essential to note that donor treatment makes additional costs within the IVF procedure. Therefore, the perception of the couple in general, particularly women, varies on the IVF and donor treatment choice. As already discussed above, upper-class women even desire to use donor eggs in their conception journey for the bodily experience of motherhood. In contrast, financially dependent women confirm this medical option both due to family pressure and individual desire to fulfil marital responsibility and secure their identity in the family.

Feminists perceive motherhood and reproduction as binary reality where technological advancement is speculated to be the tool of freedom that would liberate women from reproductive obligation and engage in economic production to attain agency and empowerment (Beauvoir, 2007; Gupta, 2000; Stanworth, 1987). On the other hand, feminist scholars with a radical approach perceive ARTs as inherently patriarchal and capitalist as a means of control on women (Mies 1993, Arditti et al.,1984; Corea, 1985).

From the analysis of women's narratives involved in the IVF treatment, the study finds that neither social structure completely controls women's reproductive choices nor does these

advanced reproductive technologies liberate women from the dominant institutional norms and values. This study argues that women exercised a “negotiated agency” within the complex web of the IVF network (Venugopal & Viswanathan, 2021). In the IVF process, women challenge the idea of ‘natural conception’ using technological assistance, which they call ‘artificial,’ ‘robotic,’ or ‘mechanical.’ In doing so, they maintain reproductive capability as a gender identity as well as social expectation. They further challenge the ‘biological link to own child’ by accepting the use of ‘donor egg and donor sperm’ to maintain conception as a natural means to achieve motherhood.

Women make IVF an alternative method to conceive despite bodily pain, emotional roller coaster, financial loss, and uncertainty to create an identity of motherhood, to fulfil social responsibility to achieve motherhood through conception and to conform to the institutional rule of marriage. Since the study involves women who have already chosen IVF as an assistant to their conception journey, they constantly negotiate with other actors in the IVF network. Their experience in the network varies based on their caste, class, and social support. Women are not a homogeneous category used in the study. They are heterogeneous in categories, belong to different caste classes, and have different social supports. Therefore, women’s choices in the IVF network are constrained, moral, and autonomous concerning their economic position, social support, and awareness.

Emergent masculinity: Negotiating hegemony with supportive masculinity

Unlike female infertility, male infertility is treated either through donor treatment or through ARTs like ICSI. It is observed in this study that men (the prospective fathers) normalise women’s ‘gatekeeper role’ who take all responsibility by keeping male infertility a secret treatment to protect family honour. Though female infertility is stigmatised in Indian society, it is eventually normalised and naturalised post-medicalisation of women’s reproductive bodies through biomedicines and assisted reproductive technologies. Against female infertility, the male reproductive body is considered by society as a perfect body that is believed to be fertile without any medical complications. Conversely, male infertility is associated with family honour (Vayena et al., 2002) and emasculation (Ouzgane, 1997). To protect their masculinity, men in the IVF network keep their public images as “powerful, virile” patriarchs (ibid:5). On the other hand, men express their vulnerability in the IVF journey and also play a supportive role to their wives in both the case of male or female infertility. Men negotiate with technology, law, medical practitioners, and the market to maintain patrilineality and patriarchy.

Patrilineality is a social system in which family descent and inheritance are traced through the father's lineage. In patrilineal societies, men are given social power with the birth of children, especially sons. A son is believed to be perpetuating patrilineal structures into the future. This system is prevalent in many societies, including Europe, North Africa, Asia, and South Asia. It is found from the study that in the IVF process, mainly those who use donor sperm seek donors to be from their own caste and skin colour. Men seeking patrilineality are mostly upper-caste and upper-class men. However, it is not to say that men from the lower or middle class and other castes apart from the upper caste do not aspire for their perspective child to be biologically linked to them. For men from the lower middle class (who are also mainly from OBC and SCs), giving birth to a child through conception is more critical as the later treatment charges additional costs.

Within the familial structure characterised by patriarchy, men typically assume the role of the household head, thereby wielding greater power and authority in comparison to women. India, as a predominantly patriarchal society, places significant emphasis on men's virility as a determining factor in their acquisition of power and dominance. The absence or perceived deficiency of virility may consequently lead to the phenomenon of emasculation. Empirical investigations in the study indicate that men face severe societal censure in the public domain when they do not attain fatherhood within the conventional timeframe post-marriage, typically designated as one year. Such public reproach is indicative of emasculation. Given the normative view of fatherhood and reproductive processes as intrinsic and ordinary, beyond caste and class distinctions, men opt for technological interventions in male infertility to safeguard their virility. Disparities in financial resources become pronounced, particularly among men of lower socioeconomic strata, engendering heightened financial burdens, thereby fostering sentiments of aggression and frustration along their reproductive journey. In the context of men interviewed for the study undergoing in vitro fertilisation (IVF) amidst financial constraints, a discernible trend emerges wherein a tendency exists among male participants to attribute challenges related to childbirth exclusively to women, even when confronted with instances of male factor infertility.

In this study, it is contended that while advanced medical technologies provide men with the capability to discern infertility, and although these technologies facilitate men's integration into the reproductive process, the realm of reproduction persists as a gendered domain. Within this gendered framework, women willingly shoulder the entirety of infertility attributions and the associated treatment expenses on their bodies, or they incur blame from patriarchal structures

where men symbolically assume the dominant role. Beyond considerations of virility, the preservation of family honour, construed as a manifestation of male prestige, represents an additional facet of patriarchy operative within the reproductive domain. This dynamic compels men to pursue infertility treatments through Assisted Reproductive Technologies (ARTs) as a means of safeguarding their hegemonic masculinity.

Notwithstanding the prevailing presence of power and dominance among men, the findings of this study reveal that men engaged in the IVF process ultimately articulate a sense of 'vulnerability and emotionality.' The manifestation of these latter traits is principally associated with a construct identified as supportive masculinity. 'Supportive masculinity implies the practice of men engaging in caring behaviours and providing support to others, mainly to the marginalised others,' i.e., the women or female partner in this context (Gough et al., 2018, p.70). It involves challenging traditional notions of masculinity that prioritise strength and emotional detachment. Instead, it promotes empathy, nurturing, and partnership (ibid). It is found in the study that "men-as-supportive-partners" in the intimate realm of reproduction offer emotional support to their wife and take on the responsibility of providing financial assistance for IVF treatment (Chopra, 2009, p.119). The accounts of men's involvement in IVF journeys challenge some conventional assumptions and stereotypes. In the narratives, some men highlight the importance of shared desires and equal partnership between spouses as they navigate the complexities of IVF with empathy and understanding.

The study finds that women demonstrate a negotiated agency, and men, while expressing supportive masculinity, negotiate the orthodox patriarchal boundaries to balance a desired marital relationship with their respective wives. Few men also have compromised their careers and temporarily supported their wives to conceive through IVF in either the case of male or female infertility. This companionship did not imply cutting off from patriarchy and hegemonic masculinity. It is argued in this thesis that technology creates a possibility that enables men to demonstrate an emergent masculinity. By expressing an emergent masculinity, men negotiate with hegemonic and supportive masculinity. Emergent masculinities refer to 'how men are adapting to changing social and cultural contexts, particularly as they encounter emerging health technologies' (Inhorn et al. 2011, p.2). The process of IVF involves various complexities that affect men and women differently based sex and gender. Other actors like medical institutions, markets, media, and the state also shape the experience of prospective mothers and fathers and vice versa in the IVF network.

An assemblage of science, technology, market, media and state

Non-human actors such as medical institutes, the state, the media, and the market play a crucial role in channelling and stabilising the IVF network. These actors are not isolated entities but interconnected elements that contribute to IVF treatment's overall landscape and development. They are all part of the same continuum, influencing and being influenced by one another in IVF practice and technology. The role of the medical institution is examined in the study from the interviews of medical practitioners, including specialist doctors, paramedical staff, and clinical counsellors. Apart from that, everyday observation of the hospital site provided enumerable information about her practice of IVF and other ARTs in the IVF network from the perspective of medical institutions. It is observed in the study that a hospital (IVF centre) is a gendered space where medical practitioners practice IVF every day, incorporating gender-normative principles. Drawing upon medical epistemology and societal values, medical practitioners play an essential role in shaping the reproductive choices of individual users.

Reproduction and the associated technological interventions exhibit a pronounced gender bias, wherein women bear the entirety of the blame for infertility, thus prompting their initiation of treatment. Despite the capacity of Assisted Reproductive Technologies (ARTs) to identify male infertility, the latter remains shrouded in what is characterised as a 'secret stigma,' as elucidated earlier. Medical professionals contribute to the normalisation of these concealed stigmas by rendering female infertility a normative condition and endorsing the routine use of ARTs. Furthermore, institutional advertisements by medical establishments exhibit the virtues of motherhood, a narrative reinforced by medical practitioners applying ARTs. Beyond the normalisation of infertility and the medicalisation of reproductive processes and bodies, the utilisation of ARTs, such as Preimplantation Genetic Diagnosis (PGD), introduces ethical considerations surrounding sex selection and selective birth through the discarding of embryos with disabilities.

Moreover, medical institutions, viewed as institutional actors, do not merely operate within the confines of the medical model; they are significantly influenced by broader societal and cultural norms that shape the utilisation of ARTs. This influence is evident, for instance, in the normalisation of donor treatments, which, in turn, complicates established notions of an 'own child' or a 'biological child' conceived through traditional means. The study posits that using ARTs within medical institutions is inherently entwined with and shaped by societal and cultural norms.

Beyond the purview of medical institutions, the regulatory context of Assisted Reproductive Technologies (ARTs) is profoundly shaped by the state, with discernible implications stemming from societal and cultural norms that significantly influence the reproductive choices available to prospective parents. The historical evolution of the Indian state from a socialist welfarist entity to an authoritative actor driven by population control objectives and subsequently assuming a regulatory role is notably influenced by the transition from a socialist welfare economy to a profit-oriented capitalist system. The integration of the Indian state into the global economy, propelled by advancements in the capitalist paradigm, has positioned the state as a critical actor in regulating ARTs.

The media assumes a pivotal role within the global economic framework, evolving from a rhetorical device to an institutional advocate for the fertility market. In its rhetorical role, the media assesses the credibility of scientists and medical professionals, particularly in the aftermath of ART interventions. Subsequently, the media transforms into an institutional ally for assisted reproductive technologies (ARTs), aligning itself with the burgeoning fertility market that has become an integral component of the global capitalist economy. The privatisation and corporatisation of the medical system in India encapsulate the assimilation of biomedicine and biotechnologies, such as In Vitro Fertilization (IVF), into its service offerings. This corporatisation of IVF and ARTs directly results from the evolving roles played by the state, media, and market. The study discerns that the IVF market strategically employs various societal mechanisms to render this technology accessible to users within the broader framework of the 'birth market' (Sarojini et al., 2011).

The study posits that the birth market strategically employs prevailing social norms and regulatory frameworks that ascribe considerable value to motherhood, effectively characterising the fertility industry as a 'motherhood industry.' As an institutional actor, the media collaborates with the market to transition the fertility industry into a 'market society,' as articulated in Polanyi's conceptualisation (2001). In this "market society, there is a notable shift whereby social relations become embedded within the economic system, diverging from the conventional notion where the economy is embedded within social relations" (Polanyi, 1944 in Polanyi, 1957, p. 57).

Medical practitioners, assuming the official role of 'gatekeepers' within the IVF network, wield the authority to determine eligibility for accessing Assisted Reproductive Technologies (ARTs), primarily favouring married heterosexual couples from the middle or upper class. This

gatekeeper role of medical practitioners enables them to determine what life is. As a result, the medical practitioners in the hospital setup possess the power to define the 'ontology of life' in the IVF practice by identifying the stage of embryo formation and determining its readiness for transfer to the uterus to grow into a complete organism. Further, this power enables medical practitioners to establish criteria for embryo discard. Through this gatekeeper function, medical practitioners recurrently shape the choices of individual users, influence medical epistemology, and shape technological utilisation within the IVF network.

In alignment with the roles of other institutional actors, the state assumes the position of a 'moral pioneer,' drawing upon prevailing cultural norms and societal values to regulate novel and intricate reproductive technologies. The Indian state confines the application of ARTs exclusively to married heterosexual couples, explicitly prohibiting their utilisation by single men and LGBTQ+ communities. This discriminatory framework, particularly evident in the case of IVF, is institutionalised by the state, reinforcing the notion that marriage represents the sole stable relationship, and accordingly, married heterosexual couples, as a homogeneous group, are vested with the entitlement to parenthood through technological assistance.

Starting with historical scrutiny of scientific epistemology and the innovation of in vitro fertilisation (IVF), the investigation discerns that IVF, from its initial adoption to widespread dissemination, persist as a "cultural object intricately intertwined within the social, political, and economic framework" [Appadurai 1986; Mauss 1928 & 1954; Strathearn 1989; Winer 1992, mentioned in Ginsburg, F. D., & Rapp, R. (Eds.), P.5].

Study contribution, limitations, recommendations, and prospect for future research

In the realm of sociology, a prevalent argument posits that individual choices are not manifestations of free will or rational deliberation but rather emanate from deeply ingrained habits of thought and action moulded by an individual's socialisation and cultural background. Sociologist Pierre Bourdieu contends that these individual choices exhibit strong patterns, creating an illusion that sociology must expose and demystify (Bourdieu, 1992, 2005). Examining non-human actors from a sociological perspective is a relatively uncommon pursuit. Only recently has the sub-disciplinary specialisation known as 'science and technology studies (STS)' provided a scope for investigating non-human actors as integral components of human life and society. Within STS, actor-network theory (ANT) serves as a framework to scrutinise

actors' choices by exploring the relationships between actors in a network and their interactions that give rise to social and natural phenomena.

Against this backdrop, the present study adopts the ANT perspective to delineate the choices and practices within the In Vitro Fertilization (IVF) network. The research reveals that decisions undertaken by various actors play a principal role in shaping the significance associated with the creation of life in vitro. By contributing to the discourse on 'choice' within the social study of assisted reproductive technology, the study argues that individual choices, particularly those of women, are not solely guided by individualist rational principles. Instead, these choices result from constant negotiations with various other actors, including technology, morality, social expectations, economy, state, media, and market within this context. The choices made by diverse actors within the IVF network undergo negotiation within a space where networks evolve through repetitive actions. Within this negotiated space, the power dynamics among actors perpetually shift in response to individual desires, choices, social expectations, moral values, and interests. The study contends that despite prevailing power inequalities among actors, the agency of both human and non-human actors remains dynamic, temporal, and spatial. As observed in the literature review, sociological research on 'men, masculinity, and reproduction' is limited, particularly in the context of IVF. This study contributes to this literature by asserting that men in the reproductive sphere express an 'emergent masculinity.' Within this form of masculinity, men uphold hegemonic masculinity while concurrently negotiating it with supportive masculinity to achieve a balanced marital relationship in a patriarchal society.

Drawing upon the conceptual framework provided by actor-network theory (ANT) and an analysis of field data, this study contributes to the existing literature on examining actors within network relationships from the science and technology studies perspective. In alignment with the notion of 'choice,' the study posits that within the In Vitro Fertilization (IVF) network, 'power' is not an inherent property of individual actors but rather a characteristic of the network itself. The investigation reveals that power dynamics within the IVF network are asymmetrical, constantly subject to negotiation and contestation as actors create and dissolve relationships. Illustratively, women employ 'negotiated agency,' men adopt 'emergent masculinity,' and medical institutions assume the role of a 'moral agent.' Additionally, state, media, and market entities act as institutional actors, exercising their power distinctively to stabilise the network. In this asymmetrical power relation, technology emerges as a potent force. The access to technology and the influence of medical epistemology empowers practitioners, providing them

with the agency to determine the ontology of life, notably defining when an embryo qualifies as life.

Moreover, technology allows doctors to negotiate with patients and access other bodies, particularly women's. In contrast, aspiring couples have comparatively less power, needing more direct access to technology and relying on dominant actors for assistance in their conception journey. However, technology, media, and the market allow individual users to negotiate with this dominant power.

These power differentials within the IVF network raises critical questions. How do power dynamics and asymmetries among actors impact the provision of IVF services? What specific practices and techniques do scientists and medical practitioners employ to negotiate power and influence within the network? The study underscores the need to explicitly explore the IVF network using Actor-Network Theory (ANT). While ANT has facilitated the development of a conceptual understanding, the data available for ANT analysis needs to be more extensive and necessitates further exploration. The study initially aimed to comprehensively analyse the IVF network, including the IVF laboratory, to elucidate the ontology and epistemology of life formation and to make non-human actors within laboratory settings. However, constraints such as time limitations and restricted access to various sites within the fertility centre led to a focus on specific areas like doctors' chambers, waiting rooms, lounges, and dining halls. A significant research gap remains in the study of the structural dimension of the IVF laboratory, which is crucial for understanding the ontology of life in vitro, power relations among medical practitioners, and the agency of embryos or prospective children. Besides, further study can be done to explore the role of materials, such as embryos, technologies, hormonal injections, sperms, eggs, and in shaping the structure and dynamics of the IVF network and to explore how these human and non-human actors mobilised within the IVF network. Additionally, the study recommends further research into the ethical dimension of innovations such as gene editing and cloning in synthetic biology, anticipating their direct impact on individual agency and the future identity of the human race.

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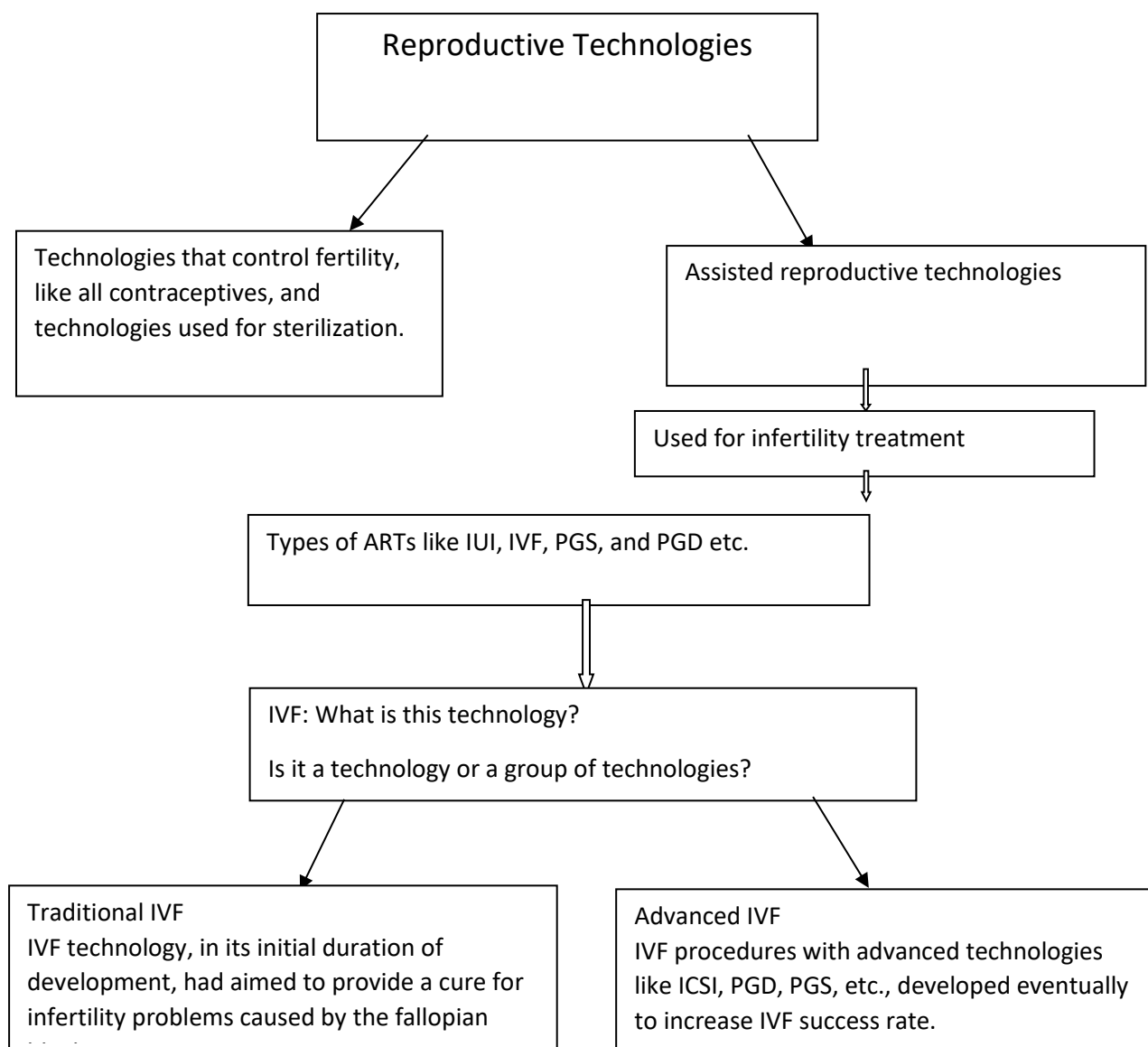
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Appendix I

Typologies of Assistant Reproductive Technologies (ARTs)

Assisted reproductive technologies (ARTs hereafter) are different from other reproductive technologies that are used to control fertility. *This thesis defines in vitro fertilization (IVF)* as conventional and advanced forms. A clear distinction among all technologies is drawn here with their distinct meaning and functions—the present research studies ARTs within 'The IVF network.' IVF procedure is a complex network that involves various techniques and technologies. IVF was innovated and used officially in 1978 for the first time to treat infertility among women with tubal blockage or fallopian tubal damage. Treatments available to treat tubal blockage involve surgical methods through laparoscopy. IVF is considered the most effective way to treat infertility among women with tubal blockage. With time, the amount of research in the area has significantly increased; therefore, many new associated technologies to treat infertility have been developed. Those new technologies are Intracytoplasmic Sperm Injection (ICSI), Pregenetic diagnosis (PGD), Pregenetic screen (PGS), techniques of oocyte retrieval, laparoscopy or sonography, assisted Hatching, gamete Intrafallopian Transfer (GIFT), injection like gonadotropins, test like Endometrial Receptivity Analysis (ERA), hysteroscopy, etc. Besides technologies, IVF networks also incorporate many biomedicines for their well-functioning. Medical practitioners often address this later development within the IVF network as advanced IVF.



IVF and the associated technologies and methods

IVF is conventionally used for women's fallopian tubal blockage or damage. From its time of development, IVF has added quite a few technologies. Therefore, as observed from the field, IVF is categorically divided in this thesis into conventional IVF and advanced IVF. The advanced IVF technology differs from its conventional form in developing assisted reproductive technologies. Each IVF procedure, technique, and associated terms have been presented in this chapter, describing their respective usages.

Endometriosis

Endometriosis is a disorder in which normal tissues that line the uterus start growing outside the uterus. They are seen to be growing on the ovaries, fallopian tubes, or intestines. Tubal

blockage is one of the major causes of reproductive failure. Therapy for endometriosis includes surgical ablation and hormonal suppression with several agents like danazol, gonadotropin-releasing hormones, progestins, etc. Women with endometriosis treatment failure generally go for IVF treatment as the last option for conceiving.

Fallopian Tubal Factor.

Most women interviewed for the study have a tubal blockage and tubal damage issue. IVF is the most important and only therapeutic option for women with absent fallopian tubes. Another treatment for such factors is the surgical repair of damaged fallopian tubes.

Gonadotropins

Gonadotropin hormones mainly consist of Luteinizing hormone (LH) and follicle-stimulating hormone (FSH). These hormones are primarily secreted from cells in the anterior pituitary called gonadotrophs. Human Gonadotropin (hCG) is administered by intramuscular injection and mainly started at 2 to 4 amps daily, particularly given on day two or three of the menstrual cycle. The timing of hCG injections is critical. If the injection is given too early, the chance of premature oocyte development will be higher; if given late, the oocyte may be postmature. The use of gonadotropins varies between IVF programs. The doses of LH and FSH are regulated according to individual patient's responses. The outcome of IVF can be measured by checking the oestradiol level. Patients with more significant numbers of oocytes retrieved have a higher chance of getting pregnant than patients with a significantly lower response.

Techniques of Oocyte Retrieval

Oocyte retrieval is generally performed for 34 to 36 hours following hCG administration. Oocyte recovery is, therefore, scheduled at an interval sufficient to allow oocyte maturation before ovulation. Both laparoscopic follicular aspiration and ultrasound-directed techniques are used for oocyte retrieval. Ultrasound-directed techniques have virtually replaced the endoscopic approach except in cases where cannulation of the fallopian tubes is required.

Laparoscopy

Oocyte recovery through laparoscopy requires at least 50 per cent visual accessibility of the total ovarian surface area. Laparoscopy retrieval is an abdominal surgical procedure typically performed with general anaesthesia. This surgery uses a two- or three-puncture technique, with an infraumbilical incision for abdominal insufflation, laparoscope placement, and suprapubic

incisions for additional instruments. Pelvic is quickly tested after all devices are placed in their places. If increased cul-de-sac fluid is noted, it might indicate ovulation and retrieval aspires. The ovaries are stabilized with gasping forceps by gentle wedging or grasping the uterus-ovarian ligaments, with care to avoid rupturing any follicles. Follicular puncture is performed in an avascular region midway between the base and dome of each follicle. Suction is applied to the needle now of follicle puncture, and the needle tip is used to curette the wall of the follicle as it collapses to dislodge the cumulus-oocyte mass. Following follicular drainage, suction is discontinued before removing the needle to minimize carbon dioxide (CO₂) aspiration. After the oocyte is retained, the needle and tubing are then flushed. Sometimes, the needle is left with a follicle if the oocyte is not identified in the initial aspirate. In this way, all the follicles are emptied before the procedure is concluded.

Ultrasound/Ultrasonographical Guided Procedure

It was in 1981 that ultrasound-directed follicle aspiration was first described. Follicle aspiration through ultrasound uses several routes, including percutaneous trans-vesical (follicle aspiration performed by injecting a needle through the urinary bladder) and transvaginal aspiration, with either transvaginal or transabdominal scanning. Transvaginal follicle aspiration with a vaginal ultrasound has become prevalent at most fertility centres.

In the procedure, the patient is placed in a dorsal lithotomy position (lying on the back with legs flexed 90 degrees at hips), and the vagina is prepped either with an antiseptic cleanser followed by copious saline irrigation or saline alone. In some cases, intravenous sedation and analgesia are used for most transvaginal oocyte retrievals with prophylactic antibiotics. Following aspiration of each follicle, the needle may either be advanced to the next follicle, removed and flushed, or kept in place until the embryologist identifies the oocyte to facilitate further flushing and respiration. Apart from ultrasound, laparoscopy is still the dominant technique in procedures requiring tubal cannulation. Tubal cannulation is a non-surgical procedure known as selective tubal cannulation. In this procedure, the doctor inserts a catheter, or cannula, through the cervix and the uterus and then into the fallopian tube to open up the tubal cornual blocks like in the case of GIFT and ZIFT. It is, however, observed that postretrieval pelvic infections, while infrequent, can be severe in some cases and may lead to abscess (swelling or inflammation) formation (Howe et al., 1988)

Gamete Intrafallopian Transfer (GIFT)

Gamete Intrafallopian Transfer (GIFT hereafter) was defined first by Asch and colleagues as consisting of controlled ovarian hyperstimulation and egg recovery followed by the transfer of sperm and oocyte into the fallopian tube(s) (Asch et al., 1986). In this procedure, fertilization happens in vivo. GIFT is generally considered the alternative treatment of IVF in cases where at least one fallopian tube is standard and in functional condition. Like in IVF, the timing of hCG administration follows a similar process. GIFT procedure is generally scheduled for 34 to 36 hours following hCG injection. GIFT is usually performed laparoscopically or less frequently through a mini-laparotomy. After the Embryologists pick up the oocyte, sperms are prepared by a washing and swim-up procedure. The doctor then loads the GIFT catheter with a mixture of evaluated gametes; usually, two mature oocytes and 100,000 actively motile sperms are transferred to each tube. The laparoscopists then cannulate each tube to a 1.5 to 2 cm depth and inject the mixture. The patient is usually discharged the same day after a few hours of rest. Most patients receive progesterone in oil, 12.5 mg intramuscularly daily from day four after the GIFT procedure up to 8 weeks of gestation. Like in IVF, serum B-hCG levels are measured by radioimmunoassay from day seven after the transfer, and pelvic ultrasound scans are performed 3 to 5 weeks after GIFT.

Male Factor and Sperm-Recovery Techniques

Oligoasthenoteratospermia, or azoospermia, is the most common condition of male sub-fertility. This condition includes low sperm (oligozoospermia) and decreased sperm motility (asthenozoospermia).

Intracytoplasmic Sperm Injection (ICSI) involves injecting a single directly into the centre of the human egg. These techniques have been used as an advanced form of IVF.

Ovulation Induction

The ovulation induction procedure is a hormonal therapy to stimulate egg development release. Injections like normal follicle-stimulating hormone (FSH) or high-dose human menopausal gonadotropin (HMG) are given to the women. These drugs are mainly designed for the use of those women who cannot ovulate on their own. Human menopausal gonadotropin (hMG) is primarily used against single oocyte retrieval as a therapy that helps improve multi-follicular recruitment. Multifollicular recruitment increases the chance of multiple embryo transfers,

increasing IVF pregnancy rates. The pharmaceutical approach to ovulation induction varies with the nature of the underlying disorder.

Assisted Hatching

Assisted Hatching is a procedure used in IVF treatment. In some cases, after embryos are created, they do not break into many cells as they should before they are implanted into the uterus. In this case, the embryo is "hatched" from its "shell" by creating a small crack in the zona pellucida. Assisted Hatching is often helpful for an embryo implant in the uterus, leading to higher pregnancy rates in some patients. Assisted Hatching is primarily used in "blastocyst culture."

Blastocyst Culture

Most IVF centre nowadays uses "blastocyst culture" rather than transforming the fresh embryo into the uterus of the women to increase the success rate. After eggs are retrieved from a woman, they are fertilized with sperm. The embryo(s) are kept in the optimal laboratory culture for 5 to 6 days for quality control. During this period, the embryo divides and multiplies its cells and becomes a blastocyst. During this period, assisted Hatching is used to hatch embryos from their outer shell for quality control. This process helps in controlling multiple pregnancies. Conventionally, a technique called 'slow freezing' has been used for freezing embryos. However, recently advanced and more sophisticated techniques called 'vitrification' are used for freezing embryo(s).

Preimplantation Genetic Testing

Preimplantation genetic testing (PGT) is a practice where some cells of the developing embryos are taken for specific genetic properties testing. The result of this test determines which embryo would be used for uterine transfer. There are two main categories of PGT, i.e., preimplantation genetic diagnosis (PGD) and preimplantation genetic screening (PGS).

Preimplantation Genetic Diagnosis (PGD)

Preimplantation genetic diagnosis (PGD) was introduced in humans in early 1989 by Australian scientist Leenda Wilton. This diagnosis is mainly performed through a biopsy of the developing embryo, or what is called trophoctoderm biopsies, to identify if the embryos carry any unidentified genetic disorder like haemophilia, sickle cell disease, cystic fibrosis, and cancer. The identified healthy embryos are selected for uterine transfer. PGD has been

commonly practised in IVF treatment in fertility centres. PGD is a costly test. PGD of a single embryo costs approximately 50 to 60 thousand in India, which might increase the IVF cycle cost.

Preimplantation Genetic Screening (PGS)/ Preimplantation Genetic Testing for Aneuploidy (PGT-A)

The preimplantation genetic screening (PGS) procedure is relatively the same as PGD but has different objectives. PGS involves screening of euploid embryos, i.e., an embryo with 46 normal chromosomes in 23 pairs of the respective couples. This screening is performed to reduce the chance of pregnancies with chromosomal abnormalities. PGS is mainly performed in IVF cases where the patient has recurrent IVF failure or repeated miscarriages due to chromosomal abnormalities, in advanced maternal age, and in men with severe male factor infertility, etc... PGT-A has hardly 'clinically validated in its ability to define a human embryo as chromosomal standard, mosaic or aneuploid. The techniques carry many challenges, like whether the eliminated aneuploid embryos should be disposed of, used for clinical purposes or research, or transferred to the uterus. What would be the pregnancy chance if they were transferred to the uterus? In case all the embryos tested aneuploid, then what will happen to the tested embryos having chromosomal abnormalities? If new embryos are developed from patients using fresh oocytes and sperm, what would be their chance of being developed as a euploid embryo? Despite the ethical and moral challenges the techniques face, it has been heavily practised by many in IVF fertility centres.

Frozen Embryo Transfer (FET)

Embryo transfer or frozen embryo transfer is depositing embryos into the uterine cavity using an exemplary catheter passed through the cervix. A trans-abdominal ultrasound monitors this process. Sometimes, Zygote intrafallopian transfer (ZIFT) is also done instead of EFT. A week after the embryo is transformed, a pregnancy test is administered. If desired, the remaining embryos (if any) are cryopreserved (frozen) in the lab for future use.

Donor treatment (Third party donor insemination)

Artificial insemination with **donor sperm** has been seen as beneficial for couples with refractory male factor infertility. Before the advent of IVF and associated techniques, no related option was available for women with premature ovarian failure (OPF). **Donor oocyte** IVF is primarily used to treat functionally agonadal women, among women with anatomically

inaccessible ovaries, hereditary genetic disorders, multiple IVF cycles failed due to poor quality, and incipient ovarian failure. In this way, donor oocyte candidates are divided into two categories: those with and without endogenous ovarian function.

Like donor eggs and sperm, **donor embryos** have become common in IVF clinics in India and elsewhere. After a successful pregnancy, the left embryos are cryopreserved for years with the consent of respective donors. The adoptive couples further use those embryos by giving their consent to the respective IVF clinics. Couples primarily use donor embryos in cases where both the couple are infertile. In other words, women who have had multiple premature ovarian failures and where a man is impotent or has erectile dysfunction (ED) and has low sperm motility are called otherwise asthenospermia or asthenozoospermia.

Hysteroscopy

Hysteroscopy is a diagnosis process generally done by the clinician on the women after the IVF cycle failed or before starting a different IVF cycle. Doctors insert a hysteroscope inside the cervix and uterus to diagnose and treat abnormal bleeding; sometimes, it removes polyps, fibroids, and adhesions. Hysteroscopy is often done before starting IVF for the first time to avoid further complications post-embryo transfer.

Endometrial Receptivity Analysis (ERA)

Endometrial receptivity analysis, or what is popularly known as ERA, is a genetic test done by taking a small sample of a woman's endometrial lining to determine the uterus condition and the exact date on which the embryo will be transferred.

Karyotyping

Karyotyping is a diagnostic test that involves examining the chromosomes in a person's cells to identify any abnormalities or genetic disorders. In the context of in vitro fertilization (IVF), karyotyping plays an essential role in assessing the genetic health of prospective parents and embryos. Before undergoing IVF, it is common for both partners to experience a karyotype analysis. This analysis involves collecting a blood sample from each partner and examining the chromosomes within the cells of the blood sample. Karyotyping aims to identify any structural abnormalities, numerical abnormalities, or genetic disorders that could be passed on to the offspring.

Post-implantation Prenatal Testing Technique: These techniques involve amniocentesis, chorionic villus sampling (CVS), ultrasound imaging, maternal blood test, etc., and have been in practice to identify foetus sex. A small amount of amniotic fluid is withdrawn from around the uterus for testing in amniocentesis. Similarly, in CVS, a small biopsy is done from the placenta. Ultrasound imaging involves a screening of the foetus after a few weeks of pregnancy, and maternal blood testing claims to identify the gene of a male foetus. This technique claims to help a couple to receive a rapid sex determination without undergoing invasive procedures. These prenatal techniques are utilized to identify the sex of a foetus within a few days or weeks of pregnancy. A woman undergoes one of the screenings or tests to select the foetus's sex. Based on the sex of the foetus, the couple choose to miscarry the pregnancy. However, the newly developed techniques, i.e., PGD and PGS, are the preimplantation techniques which involve less risk compared to the prenatal sex selection techniques and are relatively more acceptable and ethically less challenging.

Appendix II

Interview Schedule (Unstructured)

For Prospective Parents

Respondents Socio-Economic Background

1. Name..... (Optional)
2. Gender.....
3. Age....
4. Age at marriage.....
5. Type of Marriage: Consanguineous (blood-related/ Not Blood-related)
6. Family Type: (Joint family/Nuclear family/Extended Family/Others)
7. Social Category
 - (i) Caste...
 - (ii) Religion...
 - (iii) Tribe...
8. Occupation...
9. Income... (personal and family...)
10. Educational background...

Aspiration for Child & Knowledge about IVF

11. For how many years have you been trying for your child?
12. How many doctors have you consulted till now? And what are the treatment methods you have tried before?
13. How did you learn about the IVF services and the present IVF centre? (Sources: Newspaper/Internet/YouTube/Hospital Website/Friends/Relatives)
14. Do you know everything about IVF technology and its complete treatment process?
15. How do you know this information? (Through the internet/explained by the counsellor/ informed by the doctor/ read from newspaper/ read any article on the internet/ watched videos on YouTube/others)?

(For Women)

Choice Making for Female Infertility

16. Why did you go for IVF treatment?
17. Do your family members (in-laws, siblings, and others) support you in your decision?
18. If yes, What kind of support do you get from them? (Emotional/Moral/Financial/other)
19. If no, what type of difficulties do/did you face?
20. Since IVF is a relatively expensive treatment, what are your sources of finance for this treatment? (Personal saving/ Sponsored by company/ Insurance/ loan from bank/EMI/ any other method)
21. Who bears the financial expense of IVF cost?

Male Infertility

22. How do you see donor treatment as an option?
23. With so much physical pain, emotional and financial burden and after multiple cycle IVF failure, why do you still choose IVF?

IVF Experiences, stigma associated & other obstacles

24. Would you like to elaborate on your current experience with the IVF treatment?
25. Did you feel any physical/emotional pain in your IVF journey so far?
26. If yes, how do/did you manage to overcome those?
27. generally, childbirth through natural pregnancy is considered normal. Consulting a doctor is sometimes seen as a stigma in some places and families. Being from this society, have you ever faced any stigmas concerning delayed pregnancy (the meaning is subject to vary)?
28. If so, would you like to share some of your experiences?
29. Does your extended family know about your IVF treatment?

For Male Infertility

30. When did you get to know about your husband's infertility issues? And how did you feel after coming to know about it? What was your immediate reaction?
31. Why do you still choose IVF for male infertility?
31. Does your family know about your husband's infertility issue?
32. Has anything changed in terms of your position or relation within your household after your husband's infertility was identified and after you started doing IVF?
33. Would you like to share your experience in this treatment?

Both Male and Female Infertility

33. Has anything changed in your marital relationship after undergoing so much struggle with IVF treatment?

34. Who finances the treatment?

Future Prospect

35. How do you feel now (either after giving up due to multiple time failures/after successfully giving birth)? Would you like to share your feelings?

To Men

36. How did you and your wife react after your infertility-related issues were diagnosed?

37. Does your family know about it?

38. If yes, how did they respond?

39. If no, how do you manage to do IVF treatment?

40. What is your opinion on male infertility?

41. What is your opinion on the use of donor treatment?

42. How do you manage finances in the treatment?

43. How do you support your wife in this tiring journey?

44. What major challenges do you face in the IVF journey?

Interview Schedule for Doctors

1. Tell me a little about your medical background and experience in reproductive counselling for IVF patients/IVF treatment.
2. Besides specializing as an Obstetrician and gynaecologist, what other degrees or training programmes have you completed to practice IVF?
3. Before going to IVF, it is important to know why the infertility rate is increasing in India. Is the infertility rate increasing more in rural India or urban areas? What are the major causes?
4. How are the patients from rural and non-medical backgrounds understood about the entire process?
5. What is the most common infertility diagnosis with the patients you treat?
6. We are talking about IVF. Please tell me what this technology is about and how it works.
7. Is IVF a homogenous technology? If not, what other treatments or diagnosis methods are associated with this technology?
8. What is your personal opinion about the practice of biotechnologies and assisted reproductive technologies like IVF, ICSI, etc.?
9. What would you advise a patient to do first when dealing with fertility issues?
10. Do the couples or their family come with prior knowledge about IVF?
11. When and in what condition of infertility IVF is suggested?
12. Do you evaluate both men and women during a consultation?
13. It seems that many people are waiting to become parents later in life. How much does age affect their ability to conceive? And how is IVF treatment useful in this case?
14. Do the couples or their family come with prior knowledge about IVF?
15. Before starting the IVF procedure, what information is provided to the couples, particularly to the aspiring mother?
16. How are the patients from rural and non-medical backgrounds understood about the entire process?

Donor Treatment

17. If a woman is not able to conceive with her egg or is no longer ovulating, is she still able to give birth to a healthy baby through IVF using a donor's egg and how?

18. Nowadays, IVF is gaining popularity, and most importantly, people accept this treatment. Is the donor treatment equally accepted by the people you treat? And is the acceptance the same for both donor egg and donor sperm?
19. In the case of known donors, what are the major aspects considered before starting the procedure?
20. How do aspiring parents, in terms of gender, class, and residential background, decide donor options?

Male Factor & Genetic Factor

21. What is ICSI (Intracytoplasmic Sperm Injection) and PGD (Pre-implantation genetic diagnosis)? Are they a specialized form of IVF?
22. How male-factor infertility problems are treated through IVF?
23. Does PGD diagnosis increase the IVF success rate? And how?
24. What is the average success rate of IVF treatment?

Side-effects and Possible Risks & Risk Management?

25. Is there any side effect of IVF treatment? And what are the possible risks associated with this treatment? How are these risks controlled?
26. There are some cases where women have multiple time IVF failures. But they still try further. If and when you treat those people, how do you manage them?
27. Are women with thyroid and PCOS problems also suggested for IVF?
28. In the IVF procedure, how are the leftover eggs and sperm used? Do you perish them after a successful pregnancy, or are they used for other purposes like research?

Finance

29. What is the average cost of IVF? Is it affordable for people of all economic classes?
30. Are ICSI and PGD costs separate from IVF treatment costs?
31. How do you think this advanced service in the reproductive field can reach those in need from every section of society?

Regulation

32. In your opinion, is IVF service well-regulated?
33. How do you follow all regulatory frameworks in IVF practice?

Opinion

34. What is your opinion on aspiring parents like lesbians or guys, single mothers without a male partner, and single fathers without a female partner?
35. What do you think the future will hold for (in)-fertility patients?

36. The patient-doctor bond is important in infertility treatment, which is often quite a long process. And why is it important?

Counselling

37. What are the different types of counselling methods/treatment options adopted for an infertile patient within the IVF procedure?
38. Do you feel that a patient's mental health affects their physical ability to get pregnant? And how?
39. How does the emotional impact of infertility affect the biological or medical practice of the aspiring parents undergoing IVF treatment?
40. How do you counsel your patients about donor adoption?
41. How are the patients counselled on the specific emotional stress that develops during the treatment process?
42. How are aspiring parents made to understand the social (future relationship with the child, emotional aspect, telling child, confidentiality with other parties, etc.) and legal rights of the future child?

To Accompanied Persons/family members/relatives (accompany the prospective mother to the fertility centre)

1. What do you mean my IVF?
2. What challenges do you think your son/daughter/relative facing during this treatment?
3. What is your opinion about IVF treatment?
4. What is opinion about donor treatment?
5. How do you support the men/women undergoing IVF?

I sincerely appreciate your time and patience. Thank you very much for your support for my PhD research work. Without you, it would not have been possible to do the research.



Appendix III

Glossary

<i>Agar</i>	If
<i>Aina</i>	However/either/ through
<i>Amma</i>	A term of endearment used to refer to women
<i>Anni</i>	All
<i>Baby kosam</i>	For a baby
<i>Bacha</i>	Baby
<i>Bidda</i>	Child in general and used for daughter in Telangana
<i>Brahmin</i>	A Hindu Upper Caste
<i>Chedu</i>	Bad
<i>Dakkadu</i>	Will not get
<i>Edaina</i>	Anything
<i>Ee baadhanu</i>	This pain
<i>Emaina okay</i>	Anything is fine
<i>Emiti</i>	What
<i>Evaru</i>	Who
<i>Godralu</i>	‘Barren,’ used especially to poke an infertile woman
<i>Gurtunchukuntaaru</i>	Will remember
<i>ham</i>	We
<i>Hastavaasi</i>	Skill/Competence
<i>Hota hai</i>	Is born
<i>hum</i>	we
<i>Itna sara</i>	All these
<i>Jangam</i>	A Hindu caste falls under Schedule Caste
<i>Janmanichina</i>	Who gave birth
<i>Ka</i>	Of
<i>Kaise bhi</i>	How may ever
<i>Kama</i>	A Hindu Upper Caste

<i>Kapu</i>	A Hindu caste falls under OBC category but locally considered
<i>Kar payenge</i>	Can do
<i>Kastam</i>	Pain
<i>Komati</i>	A Hindu Caste falls under OBC category
<i>Kosam</i>	For
<i>Kuch nehin</i>	nothing
<i>Lenide</i>	Without it/that
<i>Manchi</i>	Good
<i>Mangalsutras</i>	A traditional marital necklace typically worn by married Hindu
<i>Marachipotaaanu</i>	Will forget
<i>Mariyu</i>	And
<i>Mehnat</i>	Hard Work
<i>Na Chetilo</i>	In my hand
<i>Napumsak</i>	Impotent
<i>Nenu</i>	Me
<i>Paapam</i>	Sin
<i>Padmashali</i>	A Hindu Upper Caste
<i>Parvaaledu</i>	Do not care/Does not matter
<i>Phalitam</i>	Result
<i>Puttina</i>	Born
<i>Rang layi</i>	Paid off
<i>Ready hai</i>	Are ready
<i>Seemanthams</i>	Baby Shower (celebrated in the Hindu ritual)
<i>Sindoor</i>	Vermilion traditionally worn by married Hindu Women
<i>Tarvaata</i>	Later
<i>to</i>	then
<i>Vaishaya</i>	Hindu caste mostly falls under OBC category



Institutional Ethics Committee University of Hyderabad

Justice TNC Rangarajan
Chairperson

Prof. Geeta K. Vemuganti
Member Secretary

Decision Letter of Institute Ethics Committee

IEC No.			
Application No:	UH/IEC/2020/253	Date of review	18-02-2020
Project Title:	Assisted Reproductive Technologies: A Socio-technical Analysis of IVF Technology		
Principal Investigator/ Co-PI:	PI: Arosmita Sahoo CI: Prof. C. Raghava Reddy		
Participating Institutes if any	----	Approval from Participating Institute	---
Documents received and reviewed	Protocol & ICF		
In case of renewal submission of update	----		
Decision of the IEC:	Approved Duration: One year from date of approval		
Any other Comments Requirements for conditional Approval	----		
Members Present	Sri Justice Rangarajan, Prof. Geeta K. Vemuganti, Dr. C.T. Anitha, Dr. Savitri Sharma, Dr. Suvashisa Rana, and Dr. Insaf Ahmed		

Please note:

- Any amendments in the protocol must be informed to the Ethics committee and fresh approval taken.
- Any serious adverse event must be reported to the Ethics Committee within 48 hours in writing (mentioning the protocol No. or the study ID)
- Any advertisement placed in the newspapers, magazines must be submitted for approval.
- The results of the study should be presented in any of the academic forums of the hospital annually.
- If the conduct of the study is to be continued beyond the approved period, an application for the same must be forwarded to the Ethics Committee.
- It is hereby confirmed that neither you nor any of the members of the study team participated in the decision making/voting procedures.

Chairperson

(Justice Rangarajan)

Member Secretary

(Prof. Geeta K Vemuganti)

Impact of Population Policies on Women's Reproductive Rights in India: A Sociological Analysis.

--- Arosmita Sahoo and C. Raghava Reddy

Abstract

The paper attempts to understand the implication of population policies on women's reproductive rights in India. On the one hand, fertility control is a legitimate aim of the family planning programme of population policies, and it gives all individuals the opportunity to control fertility freely. On the other hand, population control is a tool to preserve the institutional interests of the state. The focus of the present work is to explore how the institutional interest of India's family planning meets the reproductive rights of women, which provides women the right to control their reproductive bodies freely. The paper describes the nuanced understanding of women's agency in the making up their 'reproductive rights,' which are constructed, reconstructed, and controlled by the state. The paper reviews the population policies of India and women's agencies here understood within an intersectional approach.

Keywords: Gender, Intersectionality, NFHS, Planning Commission, Women's Agency

Introduction

Historically, around the world, women's life, sexualities, and fertility have been manipulated by the state for political or developmental projects (Correa, 1994; Rao, 2004). The population policies aim to express a relationship between development and demographic goal by the states and governments (Cervantes-Carson, 2004). In the process, women have always been at the center stage of all population policies. In the policies, women's bodies and sexuality have often been reduced to a 'reproductive body' by both the state and developmental and reformers (Anandhi, 1998). These policies have hardly considered women as active agents of development and empowerment. Initially, the Population Policies of India were to control its population for the overall growth and development of the state economy; new population policies eventually adopted methods that tried to emancipate women. These methods have attempted to increase the marriage age and allowed women to become part of the capitalist economy by providing employment opportunities. In this context, it is important to understand how the state has seen or manipulated women's agency. How do the state and other agencies create gender in the population policy of India? And how a woman's right is constructed throughout India's Population Policies in a country with high structural inequality? What do women's rights mean to the state?



CERTIFICATE

This is to certify that

Arosmita Sahoo

Presented a paper '**Changing media role in shaping Assisted Reproductive Technologies (ARTs): From rhetorical device to institutional advocate.**' in the panel '**8A-THE STATE, DEMOCRACY AND GOVERNANCE IN THE DIGISCAPE**' in the 19th IUAES WAU World Anthropology Post Congress 2023 on the theme '**Anthropology & Digital Cultures**' organized by Department of Anthropology, University of Hyderabad on 26-27 October 2023.

Prof. M Romesh Singh
Convener

Dr. Alok K Pandey
Co-Convener

Dr. Srinivasu Nookarapu
Co-Convener

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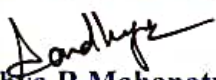
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CERTIFICATE

This is to certify that AROSMITA SAHOO

presented/participated in the International Seminar on 'Maternal & Child Health in Empowered Action Group States: Sustainable Development Goals Perspective' and presented paper entitled LEGITIMIZING REPRODUCTIVE RIGHTS AND ITS IMPLICATION ON WOMEN

held on April 5th - 6th, 2019 at A N Sinha Institute of Social Studies, Patna.


Dr. Sandhya R Mahapatro
Seminar Convenor
ANSISS, Patna


Prof. Nil Ratan
Registrar (I/C)
ANSISS, Patna

Assisted Reproductive Technologies, Networks, and Agency: A Sociological study in Hyderabad

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