EFFICIENT ASSISTED REPRODUCTIVE CARE SUPPLY CHAIN : A CASE STUDY OF CHINESE IVF' PATIENT FROM CHINA TO THAILAND

YIDAN ZHANG

A Thesis Submitted to the Graduate School of Naresuan University
in Partial Fulfillment of the Requirements
for the Master of Science in (Logistics and Supply Chain)
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has been approved by the Graduate School as partial fulfillment of the requirements for the Master of Science in Logistics and Supply Chain of Naresuan University

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Title EFFICIENT ASSISTED REPRODUCTIVE CARE SUPPLY CHAIN : A CASE STUDY OF CHINESE IVF' PATIENT FROM CHINA TO THAILAND

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Keywords Reproductive care, assisted reproductive care, assisted reproduction technology, assisted reproductive care in China, assisted reproductive care in Thailand, efficient supply chain

ABSTRACT

According to the WHO, infertility will be the third most serious disease worldwide in the 21st century. One category of cross-border medical tourism, cross-border reproductive care (CBRC), colloquially known as reproductive tourism or fertility tourism has been developed rapidly. Now, reproductive tourism becomes a worldwide phenomenon. Since Chinese government introduced a universal two-child policy in 2016, the birth rate of China has increased lately. There is a marked increase in the number of people over the age of 35 who have fertility needs. But people over the age of 35 must rely on medical means due to the decline in ovarian function and the decline in sperm quality. Although, Chinese government has launched the policy for increasing birth rate. On the one hand, there are many infertilities who needs assisted reproductive technology in China recently. On the other hand, China's assisted reproductive market is in short supply. Therefore, a lot of Chinese patients go abroad looking for assisted reproductive treatment. Besides, complicated procedures have been specified for assisted reproductive treatment due to regulation of each country. Thus, this research is focus on the study of Chinese patients' reproductive travel supply chain from the patients experience by using an online questionnaire. In addition, in deep interview has been employed with other players who are involved in assisted

reproductive care supply chain i.e., physician, representatives from medical intermediary company. Then the current supply chain structure of assisted reproductive care in Thailand is visualized for examining the problem of the current situation of assisted reproductive care. Furthermore, two scenarios to the challenge are proposed. In addition, customer journey map as a tool is used to map patients' experiences of current, scenario 1 and scenario 2 when they interact with the steps involved in a service.

The results indicate that employees with fixed jobs are the most participants, higher success rate, good medical technology and services, sex or trait selection, the long treatment waiting list in own country, and privacy—not wanting others to know about the treatment were identified to be the motivations for them to traveling to Thailand. They tend to outsource their travel arrangement to medical intermediary company, and they are satisfied with their journey. Moreover, high pressure and tight time were identified to be the challenges in reproductive travel. Scenario 1 and Scenario 2 both relieves the patient's time constraints, reduce the cost. However, in terms of customer goals, Scenario 1 can fulfill the patient's goal, Scenario 2 is difficult to fulfill the patient's goal. Therefore, Scenario 1 is more efficient.

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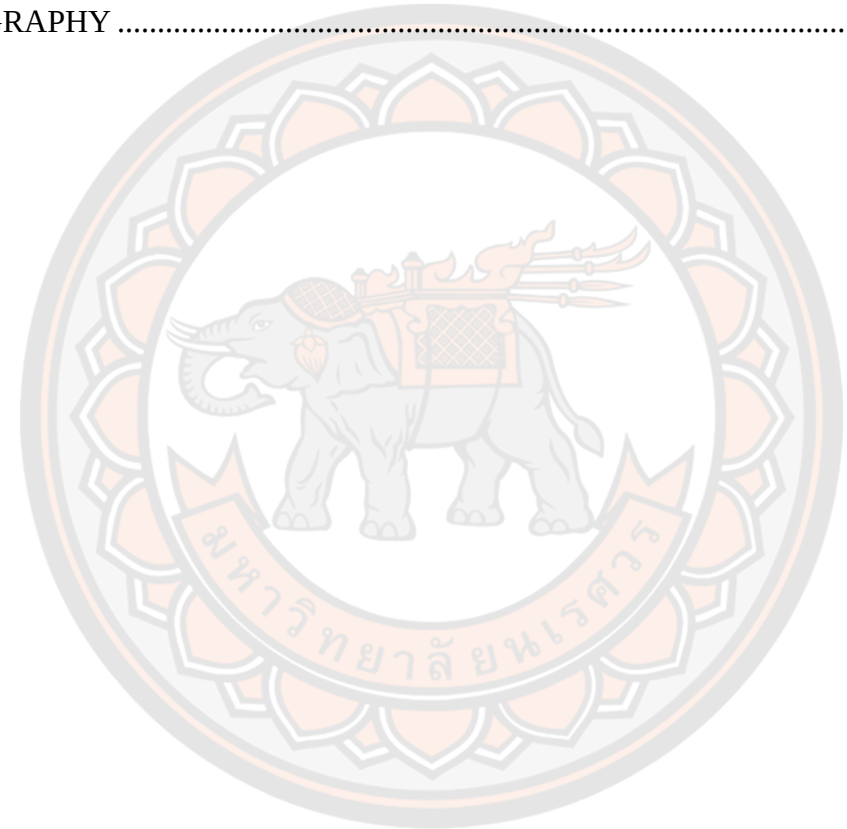

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ABBREVIATIONS

CAGR	=	Compound Annual Growth Rate
JCI	=	Joint Commission on Accreditation of Healthcare Organizations
CBRC	=	Cross-border Reproductive Care
WHO	=	World Health Organization
ART	=	Assisted Reproduction Technology
IUI	=	Intrauterine Insemination
IVM	=	In Vitro Maturation
eSET	=	elective Single Embryo Transfer
bET	=	blastocyst Embryo Transfer
PGD	=	Preimplantation Genetic Diagnosis
NHCPRC	=	National Health Commission of the People's Republic of China
ICSI	=	Intracytoplasmic Sperm Injection
CJM	=	Customer Journey Map
SC	=	Supply chain
ESC	=	Efficient Supply Chain

CHAPTER I

INTRODUCTION

Background

With the development of globalization in healthcare, medical tourism is a rising global phenomenon in the 21st century (Hoz-correa and Mu 2018). In search for cheaper, better quality medical services and shorter waiting lists, many people travel abroad to obtain medical care. According to Allied Market Research (Sanjivan Gill & Onkar Sumant 2019), the value of global medical tourism market in 2017 was $53,768 million, what is more, the market trend is rising in the next few years, which registering a CAGR of 12.9% from 2018 to 2025 and is estimated to reach at $143,461 million by 2025. While, the most active region is the Asia-Pacific region, where would exhibit the highest CAGR of 14.4% during 2018-2025. The development of medical tourism in the Asia-Pacific region benefits from good quality care but less cost than in North America. Especially, Thailand is considered to the highest contributor to the Asia-Pacific medical tourism market.

One category of cross-border medical tourism, cross-border reproductive care (CBRC), colloquially known as reproductive tourism or fertility tourism, has been developed rapidly. At the moment, CBRC becomes a worldwide phenomenon (Culley, L. et al., 2011; Rodino, I. S., Goedeke, S., & Nowoweiski, S., 2014). Although, there is evidence of CBRC occurring in many countries worldwide, there are a few reliable data on the incidence (Culley, L. et al., 2011; Salama, M. et al. 2018). Scilicet, CBRC lacks regulatory, it is difficult to obtain the data on the number of patients who cross-border looking for assisted reproduction care. However, according to the WHO, infertility will be the third most serious disease worldwide in the 21st century (Qiao, J., & Feng, H. L., 2014), approximately 9% of couples worldwide are suffer from infertility, and currently, the most effective fertility treatment is assisted reproduction technology (ART). In recent years, CBRC has been debated, which has a significant growth. Moreover, many researches have been investigated for CBRC that consists of exploring patient motivations(Bennett, L., & Pangestu, M., 2017; Culley, L. et al.,

2011; Hudson, N. et al., 2011; Rodino, I. S., Goedeke, S., & Nowoweiski, S., 2014), religious restrictions (Zanini, G., 2011), Laws and regulations (Gu 2011; Van Hoof, W., & Pennings, G., 2011; Storrow, R. F., 2011), and many more. All this research evidence shows mounting interest in this phenomenon.

China's 40 years of reform and opening-up have brought about great changes in China's economy, China's economy is developing at a high speed, people's living standards have improved. But the population problem is getting sharper and sharper. Since the Chinese government has implemented family planning in the 1970s, China has well controlled the population. However, China's low birth rate, insufficient labor supply, gender imbalance, and an aging population have affected economic development. To solve the mentioned population problem, Chinese government introduced a universal two-child policy in 2016. Based on the two-child policy, the birth rate of China has increased lately. There is a marked increase in the number of people over the age of 35 who have fertility needs. But people over the age of 35 must rely on medical means due to the decline in ovarian function and the decline in sperm quality, resulting in a significant decline in the ability to naturally conceive. In China, exposure to radiation, pesticides and other environmental pollutants, work-related stress and unhealthy lifestyles are contributing to increase the incidence rate of infertility. A recent study concluded that 15%-20% of the reproductive age women in China suffer from infertility, translates into 40-50 million women (Qiao, J., & Feng, H. L. (2014). After more than 40 years of development, Chinese ART has no inferior to other countries in the world. In terms of ART facilities, according to National Health Commission of the People's Republic of China, there are 451 medical institutions approved for assisted reproductive technology treatment by the end of 2016, covering 31 provinces, autonomous regions, and municipalities throughout mainland China. In terms of ART services, China is dedicated to providing their patients with all of the procedures that fall under the ART umbrella, which including artificial uterus insemination (IUI), in vitro maturation (IVM) of oocytes, oocytes cryopreservation, elective single embryo transfer (eSET), and blastocyst embryo transfer (bET), vitrification, preimplantation genetic diagnosis (PGD)/screening (PGS) (Qiao, J., & Feng, H. L. (2014). However, according to National Health Commission of the People's Republic of China (NHCPRC), China's assisted reproductive institutions can annually complete 700,000

assisted fertility surgeries average, which demonstrates that China's assisted reproductive market is in short supply. Therefore, a lot of Chinese patients go abroad looking for assisted reproductive treatment recently.

Thailand's soft and hard conditions laid the foundation for the rapid development of medical tourism. Thailand's geographical location in Asia is unique, convenient transport, beautiful view and unique customs have attracted thousands of tourists from all over the world every year. In addition, Thai medical services are world-renowned, because of its outstanding medical foundation that includes premium medical services, qualified healthcare specialists and various internationally accredited medical facilities. Further, Thai government also has a ten-year policy, which is executed from 2016-2025, aim to help the country achieve the goal of "Thailand, a Hub of Wellness and Medical Services" (Ministry of Public Health). Currently, Thailand' 53 JCI accredited hospitals and 4 receiving advanced HA are among the first to receive accreditation in Asia. Wherefore, foreign patients like to come to Thailand for treatment and recuperation, foreign patients coming trend every year is on the rise, as shown in Figure 1.

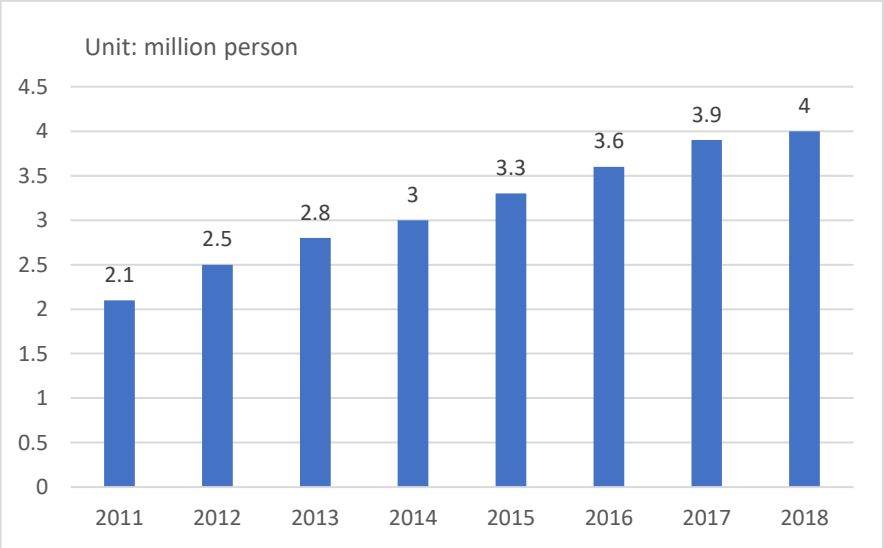

Figure 1 Number of foreign patients in Thailand

Source: SCB Economic Intelligence Center

With the birth of the first Thai baby conceived through IVF in 1978, Thailand's assisted reproductive technology has developed rapidly has gradually evolved from some simple facilities in public and university hospitals in Bangkok to the mainly private sector and advanced research facilities and has spread throughout the country. Due to the superior medical infrastructure and expertise, and lower-wage structures, Thailand is evolving as major hubs of reproductive trade in Asia (Whittaker, A., 2010). And the use of PGD for sex select as a driver of the trade for Thai clinics enhance Thailand to be an Asian 'baby factory' for foreigners. There are media reports revealing that 70-80% of patients in the big IVF clinic or hospital are Chinese patients, however, there has been no related research in this area so far.

Therefore, the purpose of this research is to study the CBRC of Chinese patients in Thailand from the supply chain perspective. First, to explore the present CBRC supply chain of Chinese patients in Thailand. Second, to identify the problem for CBRC supply chain of Chinese patients in Thailand. Third, to design an efficient supply chain in order to improve the present supply chain.

Objectives

This study is designed to research efficient supply chain for assisted reproductive care from China to Thailand. First, the present supply chain for assisted reproductive care from China to Thailand will be explored. Then, the improvements are proposed in order to establish a more efficient supply chain.

1. To explore the current assisted reproductive care supply chain structure of Chinese patients in Thailand.

2. To identify the challenges for assisted reproductive care supply chain structure of Chinese patients in Thailand.

3. To design an efficient supply chain structure in order to improve the present supply chain.

Significance

Current assisted reproductive care studies are more attention to its special ethical and social implication. There is limited literatures study in assisted reproductive care supply chains and Chinese patient' treatment trajectory abroad, so this study

intends to fill in this gap. Moreover, this study research on assisted reproductive health from a supply chain perspective, provide empirical evidence in this filed. Further, the results of this study provide management advice for policymakers to strengthen international cooperation will be completed.

Scope of study

This research aims at Chinese IVF' patients who have complete their treatment in Thailand, therefore, the scope of the research object is specified in citizens of the right age from mainland China, the right age means men over 22 years old, women over 20 years old. Also need to point out is, research object must have completed treatment in Thailand.

Further, since the author has no knowledge on biomedical background, the content related to the medical department will be considered as a touchpoint in the patient's journey. Detailed activities happen in hospital or clinic will not be included in the scope of the study.

Research framework

This research aims to design an efficient assisted reproductive supply chain for Chinese IVF patient', in order to fulfill this aim, this article will study the driving factors of supply chain from the aspects of market and supply chain network structure. Time, cost and service quality are determined as efficient supply chain measurement metrics. The research framework as shown in Figure 2.

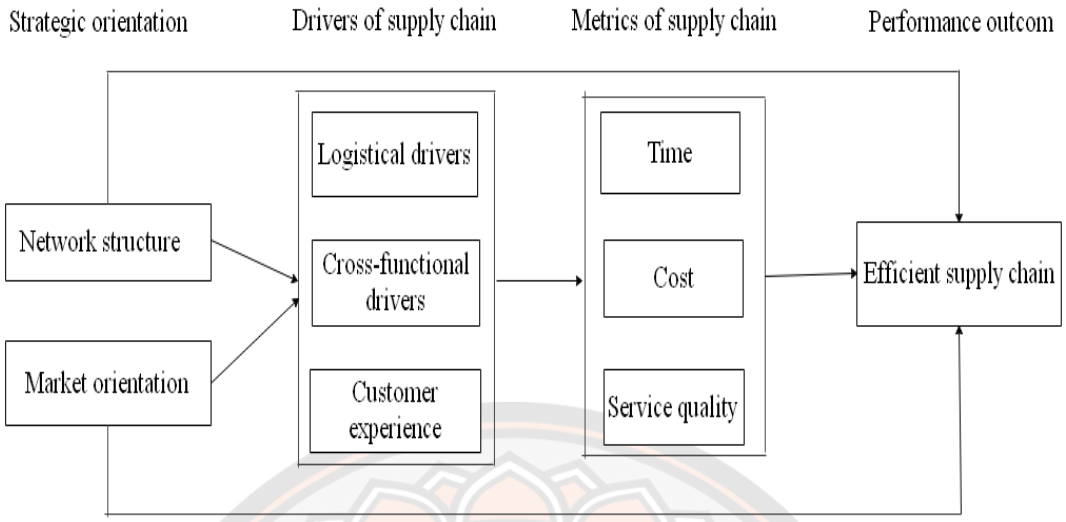

Figure 2 Research framework

CHAPTER II

LITERATURE REVIEW

Reproductive care, assisted reproductive care, assisted reproduction technology, assisted reproductive care in China, assisted reproductive care in Thailand, efficient supply chain is used as keywords to search for related English and Chinese papers in Scopus, ScienceDirect, Google Scholar, CNKI databases respectively. This chapter aims to answer the following questions: 1) The definitions and incidence of assisted reproductive care. 2) Assisted reproduction technology (ART) and In vitro fertilization (IVF). 3) The related work on CBRC . 4)The development of assisted reproductive care in China and Thailand. 5) Supply chain (SC) and efficient supply chain (ESC).

The definitions and incidence of assisted reproductive care

CBRC, procreative tourism, reproductive tourism, fertility tourism or reproductive exile is the terminology used to describe the activities of infertility patients seeking assisted reproduction technologies treatment across borders. Current researches have different definitions of CBRC, Salama, M. et al. (2018) defined CBRC as the phenomenon of people travels internationally to obtain fertility treatments. Van Hoof, W., Pennings, G., & De Sutter, P. (2015) defined CBRC as across border movement for law evasion, aim to make use of ARTs forbidden in the home country, or certain categories of patients are forbidden access to. Reproductive tourism was defined as infertile individuals and couples, in order to receive medical (Inhorn and Patrizio 2009). In addition, reproductive tourism has been defined as candidate service receivers travel from one institution, jurisdiction or country that they can't obtain treatments to another institution, jurisdiction or country that they can obtain the treatments of assisted reproduction they want (Inhorn and Shrivastav 2010). In this research, the author defines CBRC as infertility patients pursue ART treatments by traveling from home country to destination country.

Since the introduction of IVF in 1978, many other ARTs have also been invented and developed. Among them, the use of In vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI) is the most widely used, are legally allowed in almost all countries worldwide (Salama, M. et al., 2018). In addition, the commonly used ARTs have third party reproduction (such as sperm, egg, and embryo donation), preimplantation genetic diagnosis and sex selection, fertility preservation (such as cryopreservation of sperm, eggs, embryos, as well as ovarian and testicular tissue).

Assisted reproduction technology (ART) and In vitro fertilization (IVF)

Assisted reproduction technology refers to the technology of artificial manual manipulation of gametes (eggs and sperm), zygotes (fertilized eggs) or embryos with modern biomedical knowledge, techniques and methods to achieve conception of pregnancy. The emergence of assisted reproduction technology has broken the continuous process of human natural reproduction, which is the undoubted revolution in the field of reproductive medicine. July 25, 1978, the birth of first IVF baby Louise Brown in the world heralded a new era in assisted reproduction, became the new milestone in human reproductive self-regulation. For nearly 40 years, human assisted reproductive technology has experienced rapid development. At the present stage, ART includes three major areas, as artificial insemination, in vitro fertilization-embryo transfer(IVF-ET) and asexual reproduction(or clone), and the explanation of artificial insemination, in vitro fertilization-embryo transfer (IVF-ET) and asexual reproduction(or clone) are shown in Table1. However, if divide by classification, ART can divide into two classifications, as shown in Figure 3.

Table 1 The explanation of artificial insemination, in vitro fertilization-embryo transfer (IVF-ET) and asexual reproduction (or clone)

Terms	Explanation
Artificial insemination	The method of injecting sperm into a female's fallopian tube for fertilization and achieving a pregnancy by using artificial techniques.
In vitro fertilization-embryo transfer(IVF-ET)	The process of removing eggs from a woman's ovary, culturing in a vessel, adding technically processed sperm.

Terms	Explanation
	The fertilized eggs are then implanted into the woman's womb to implant, develop and give birth.
Asexual reproduction (or clone)	The process of producing genetically identical individuals of an organism either naturally or artificially.

Source: (Huang, 2006)

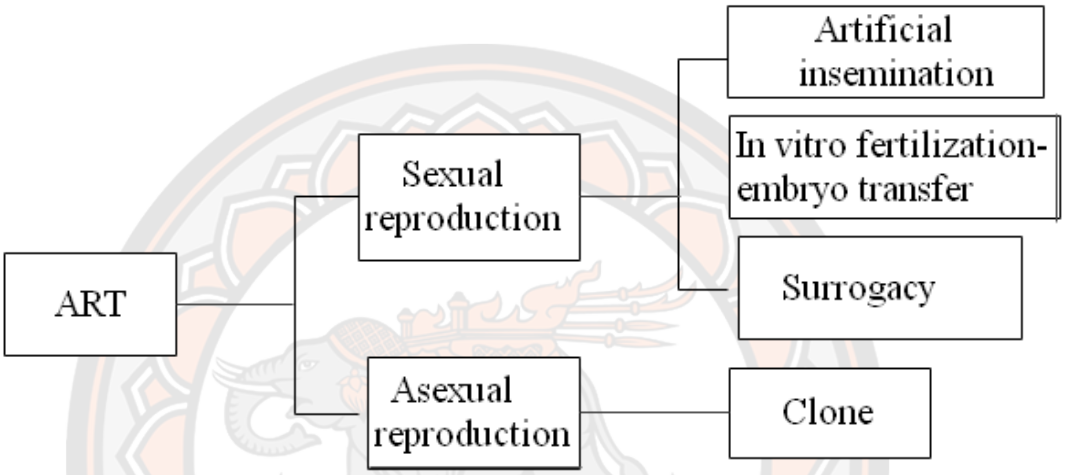

Figure 3 The classification of ART

Source: YAO, H., CHEN, K., & CHEN, L., 2017

Among them, IVF be viewed as an effective treatment for most form of subfertility, as well as a test of reproductive potential, since it can conduct a detailed assessment of oocytes, oocyte sperm interaction and embryo quality (Ola and Ã, 2005). After continuous development, IVF technology and its derivatives mainly include Drug-stimulated superovulation, in vitro fertilization-embryo transfer (IVF-ET), intracytoplasmic sperm injection (ICSI), Pre-implantation genetic diagnosis (PGD), and gamete and embryo cryopreservation and so on. Yu et al. (2012) revealed indications for in vitro fertilization and the factors affecting in vitro fertilization success. While, Ola and Ã (2005) gave the details about the IVF working process and the drugs needed in the process.

The related work on CBRC

The development of ART breaks the natural human reproductive regulation, gives hope to many infertility patients. However, ART also cause a lot of society, ethic and laws debate, specifically, reproductive travel (or fertility travel, CBRC) which is derived from ART, has attracted attention from the popular press, as well as academic, policy and legal (Bennett, L., & Pangestu, M., 2017; Gu 2011; Van Hoof, W., Pennings, G., & De Sutter, P. (2015); Hudson, N., & Culley, L., 2011; Rodino, I. S., Goedeke, S., & Nowoweiski, S., 2014; Storrow, R. F., 2011); Wilson 2016; Zanini, 2011). The previous research literature on reproductive travel has focused on two major sections: patient's reproductive travel experience and the debate on reproductive travel and regulation.

1. Patient's reproductive travel experience

Previous literature about reproductive travel tends to study patients' experience. For example, Rodino, I. S., Goedeke, S., & Nowoweiski, S. (2014) had explored the motivations, clinical care, counseling, and support experiences of Australian and New Zealand participants considering or having participated in reproductive travel. Bennett, L., & Pangestu, M., (2017) explored the preferences and decision-making processes of 15 married infertile Indonesian couples, of high socioeconomic status, regarding intra-regional reproductive travel in Southeast Asia. Zanini, G. (2011) investigated the case of Italians travelling abroad for fertility treatments as a reaction to the restrictive Italian law regulating medically assisted procreation. Hudson, N., & Culley, L. (2011) studied the UK patient's assisted reproduction travel by explored individual travel trajectories. Hoof, Pennings, and Sutter (2015) studied the experiences and moral perspectives of French lesbian couples and single women were crossing the border to Belgium to access to treatments with donor sperm. Blyth (2010) investigated patients' experience information by an international online survey in collaboration with patient support groups in Australia and Canada. Hammarberg, Stafford-bell, and Everingham (2015) demonstrated the motivations, information and support needs for intended parents when seeking extraterritorial compensated surrogacy.

Generally, the result of patients' reproductive travel experience can answer "6W" questions, which is: who seeking the reproductive travel? where do patients find

information? What type of treatment are patients looking for? where do patients consider treatment? Why patients seek reproductive travel? Who helped with arrangements?

Undoubtedly, the main participants in reproductive travel are women of advanced reproductive age (Hudson, N., & Culley, L., 2011; Rodino, I. S., Goedeke, S., & Nowoweiski, S., 2014). After all, in terms of childbirth, the role of women is irreplaceable. And the greater reproductive age of women, the higher the risk of infertility. 93% of participants in the research Blyth (2010), their age were over 30 years of age. Participants selected in the study of Gerrits (2018), 75% were women and their average was 41. What's more, the participants involved in the research of Van Hoof, W., Pennings, G., & De Sutter, P. (2015) were all women, and the average age of them was 35.5 years. Furthermore, extensive literatures give the evidence that the main participants who took part in the reproductive travel were identified for career woman. Thus, career women of advanced reproductive age are the main participants in reproductive travel.

In terms of the sources of information, multiple channels were discovered. The Internet and other media represent the main sources of information accessed in the research of (Blyth, 2010). However, Van Hoof, W., Pennings, G., & De Sutter, P. (2015) revealed the internet forums was the main sources of information for French women who go to Belgium for treatment with donor sperm. Furthermore, Zanini (2011) expressed the advice offered by Italian doctors was important information for Italian patients to take part in the CBRC. In addition, overseas surrogacy agency websites were identified to be the most common source of information for intended parents who seeking extraterritorial compensated surrogacy (Hammarberg, Stafford-bell, and Everingham, 2015). Therefore, the Internet was identified as the main channel for sourcing information of participants in reproductive travel.

As for the type of treatment that the patients looking for, it can be said to be diverse. The type of treatment to take depends on the actual physical condition of the patient. The doctor will give the appropriate treatment plan based on the patient's examination results. As mention before, ART includes three major areas, as artificial insemination, in vitro fertilization-embryo transfer (IVF-ET) and asexual reproduction (or clone). And IVF-ET is technique that is commonly used to solve various infertility

problems in humans. As this technology continues to mature, other technologies have been derived, for example, intracytoplasmic sperm injection (ICSI) and Preimplantation genetic diagnosis (PGD). With the diversification of patient needs, third-party reproduction is also emerging, as sperm, egg, and embryo donation, surrogacy, and fertility preservation. Although, IVF and ICSI are widely and legally used worldwide, in some countries, certain groups (older women, unmarried couples, single individuals, gay and transgender patients) are still prohibited. The use of PGD isn't extensive in European countries, however, it is the selling point of Thailand and the United States.

Where do patients consider treatment? Why patients seek reproductive travel? The current literature revealed that motivational factors were closely linked to the destinations for patients to pursue treatment. The ultimate goal of reproductive travel is to realize the desire of patients to become parents, the decision of destination is to achieve this goal, and the decision making is based on motivation factors. Such as, UK patient travel to the US clinic to enhance chances of success (Hudson, N., & Culley, L., 2011). French women go to Belgium for treatment with donor sperm for law evasion, etc. In summary, reproductive travel destinations show diversity, again, these decisions were context-bound and related to personal circumstances, characteristics and forms of treatment required. In addition, motivation for reproductive travel is a theme that is often mentioned. Although, the current empirical research prove the diversity of motivation, Inhorn and Patrizio (2009) had summarized 7 discrete but often interrelated motivation factors underlying reproductive tourism: 1) home country prohibit a specific service for religious or ethical reasons; 2) lack of expertise, personnel, and equipment causes a specific service to be unavailable; 3) a service be unavailable due to consider dangerous and unknown risks; 4) certain categories of people on the basis of age, marital status, or sexual orientation can't receive a service; 5) services may be unavailable due to shortages and waiting lists, especially for donor gametes; 6) some people have privacy concerns;7) treatments cost is cheaper in other countries. Points, Incidence, and Cbrc (2016) think the motivations of CBRC can fall into four basic categories: 1) Access broader and higher quality care; 2) reduce the cost of fertility care; 3) circumvent ART law; 4) privacy and cultural comfort. Furthermore, Pennings et al. (2008) expressed that the different causes of CBRC can be divided into two groups:

legal restrictions and availability of good quality care. This research also summarizes motivations influencing decision to consider or participate in reproductive travel, as shown in Table 2.

Furthermore, the arrangements for reproductive travel are also different. Hudson and Culley (2011) had demonstrated UK patients were the manager and controller for the reproductive travel. Before deciding on treatment destinations, patients had reconnoitered countries and clinics, exchanged with clinicians to ask detailed questions about possible courses of treatments, success rates via email, made travel arrangements, seek accommodation, understand the logistic availability. However, Whittaker and Speier (2010) studied on fieldwork in Thailand, the United States, and the Czech Republic and found that a number of medical facilitation companies act as intermediaries for patients by organizing contacts with medical facilities. These companies arranged travel, accommodation, concierge and translation services. Furthermore, they accompanied the patients to the doctor, follow up the patient's treatment.

In addition, the challenges on reproductive were identified in some literatures, as language, information, absence from work.

Table 2 Motivations influencing decision to consider or participate in reproductive travel

Motivation item	**Author**
Home country prohibits a specific service for religious or ethical reasons	(Zanini, G., 2011),(Whittaker, A., 2010),(Van Hoof, W., Pennings, G., & De Sutter, P., 2015),(Rodino, I. S., Goedeke, S., & Nowoweiski, S., 2014)
Lack of expertise, personnel, and equipment causes a specific service to be unavailable	(Bennett, 2017), (Whittaker, 2010), (Hammarberg, Stafford-bell, and Everingham, 2015)
A service be unavailable due to consider dangerous and unknown risks	(Zanini, G., 2011),(Blyth, 2010)

Motivation item	Author
Certain categories of people on the basis of age, marital status, or sexual orientation can't receive a service	(Hudson, N., & Culley, L., 2011)
Services may be unavailable due to shortages and waiting lists, especially for donor gametes	(Hudson, N., & Culley, L., 2011),(Blyth 2010),(Rodino, I. S., Goedeke, S., & Nowoweiski, S., 2014)
Some people have privacy concerns	(Bennett, L., & Pangestu, M., 2017)
Treatments cost is cheaper in other countries	(Bennett, L., & Pangestu, M., 2017),(Hudson and Culley 2011 Hudson, N., & Culley, L., 2011),(Blyth 2010)
Success rates	(Hudson, N., & Culley, L., 2011),(Blyth 2010)

2. The debate on reproductive travel and regulation

Nation-states of the world often use the law as a tool for regulating ART, but due to the difference of cultural attitudes, traditions, religious views, and the majority's moral position, the ART regulations are wide differences (Storrow, R. F., 2011). Therefore, the relationship between reproductive travel and ART regulations caused a lot of discussion.

Whittaker, A. (2010) considers that reproductive travel in Asia will create ethical, legal and regulatory complexity, and require cooperation across sectors, international government organizations, state, and non-state actors to deal with the transnational interdependence it involves and to protect the rights of vulnerable groups.

Storrow, R. F. (2011) considers that law interacts with reproductive travel in four important ways. First, law can trigger reproductive travel, encourage patients and physicians to seek more permissive legal regimes. Second, a country's laws may act extraterritorially to ban cross-border procurement or delivery of procedures banned at home. Third, the law may deny legal recognition of children born abroad, using techniques disapproved in the home country. Finally, law may give civil sanctions for physicians, attorneys and brokers involved in the reproductive travel.

However, Van Hoof, W., Pennings, G., & De Sutter, P. (2015) indicates that local physicians help patients during reproductive travel for law evasion should not be bound by morals and legal sanctions.

To summarize, the current literatures are focusing on the experience of CBRC patients and regulation. However, no studies have been found on Chinese patients and rarely found research from a supply chain perspective. And this became the motivation of this thesis.

The assisted reproductive care in China and Thailand.

Actually, the development history of ART in Chain and Thailand is synchronized. According to Huang 2006; Whittaker (2016), assisted reproductive care in Chain and Thailand started in the 1980s. After more than 30 years of development, ART in Chain and Thailand have made a great progress. In terms of ART facilities, according to National Health Commission of the People's Republic of China, there are 451 medical institutions approved for assisted reproductive technology treatment by the end of 2016, covering 31 provinces, autonomous regions, and municipalities throughout mainland China. And in Thailand, there are 87 medical institutions provide assisted reproduction technology treatment in mid-2017, but 70% are located in Bangkok. In terms of technology, ART in China and Thailand have reached internationally advanced levels. In China, the ART centers can provide all of the treatment procedures that fall under the ART umbrella, including artificial uterus insemination(IUI), in vitro fertilization (IVF), and blastocyst embryo transfer (BET) (Qiao, J., & Feng, H. L. (2014). As for Thailand, due to its sophisticated medical infrastructure and expertise and awesome services, ART in Thailand obtain a high reputation internationally, moreover, regulatory frameworks (or the lack of them), good tourist infrastructure, and the availability of translators enable to Thailand developed into major hubs for international assisted reproductive care (Whittaker, A., 2011). Specifically, in recent years, more and more Chinese patients choose to go to Thailand for assisted reproduction treatment. In the development history of ART in Chain and Thailand, the major technological breakthroughs will be summarized in **Table 3.**

Table 3 The major technological breakthroughs in the development history of ART in Chain and Thailand

Events	Years	
	China	Thailand
The first sperm bank	1981	1984
The first baby born through IVF	1988	1987
The first baby born through gamete intra-Fallopian transfer	1988	1987

The development of ART in China and Thailand is more and more mature, the ART obtain more and more acceptance from public. However, with the development of trade and the trail of regulation and policy, assisted reproductive care in China and Thailand both suffer legal and ethical challenges. The next will demonstrate relevant regulations, guidelines and laws related to assisted reproductive technologies in China and Thailand, as shown in Table 4.

The current regulations on assisted reproduction in China are Managerial Method for Human Assisted Reproduction, Managerial Method for Human Sperm Bank, Technical Standard for Human Assisted Reproduction, and Technical Standard for Human Sperm Bank, which affected on October 1, 2003. The purposes for these regulations are to ensure that assisted reproductive technology can be fully and safely implemented in China and effectively protect the health rights of the people. The current regulations on assisted reproduction in Thailand is Protection for Children Born Through Assisted Reproductive Technologies Act, B.E. 2558. Its main purpose is to protect children born through assisted reproductive technology, to specify the parents' legal status and protect the rights of the children, to control and specify the rights and duties of related parties during and after surrogacy, to control and determine the boundaries for proper use of enhanced ART, and to prohibit commercial surrogacy involving enterprises through agents (Chiamchanya and Pruksananonda, 2020; Stasi, 2017). The proposing of Protection for Children Born Through Assisted Reproductive Technologies Act, B.E. 2558 has a social background. Before 2014, commercial surrogacy in Thailand was legal, became heavily promoted for this industry. The controversial cases in 2014 attracted public attention, which violated medical

guidelines. First, 12 "target" clinics were surveyed, which found a number of clinics advertising sex selection services in breach of Thai Medical Council guidelines. Second, In August 2014, media reports a Japanese man fathered fifteen babies to multiple surrogate mothers in Thailand and had fled the country with at least three of the babies. Third, the baby Gammy case, an Australian hired a Thai surrogate mother through a surrogacy arrangement in Thailand, and then got a twin, however, the baby named Gammy who was born severely handicapped (Down Syndrome) was abandoned in Thailand. These cases caused a lot of discussion in the society at that time. Therefore, in November 2014, Thailand's National Legislative Assembly approved the legislation, and the Thai Parliament passed the legislation in February 2015 (Act et al. 2015; Chiamchanya and Pruksananonda, 2020; Stasi, 2017; Whittaker, A., 2016).

Table 4 The relevant regulations, guidelines and laws related to assisted reproductive technologies in China and Thailand.

Country	Regulations, Guidelines and Laws
China	1.Managerial Method for Human Assisted Reproduction 2.Managerial Method for Human Sperm Bank 3.Technical Standard for Human Assisted Reproduction 4. Technical Standard for Human Sperm Bank
Thailand	Protection for Children Born Through Assisted Reproductive Technologies Act, B.E. 2558

Next, this research will compare the content of the current regulations. As shown in Table 5.

Table 5 The comparison of regulations of China and Thailand

Item	China	Thailand
Access to the artificial insemination	ID card, marriage certificate, and birth certificate	Marriage certificate
PGD and sex selection	Mainly used for high-risk groups of children with single gene related genetic diseases, chromosomal diseases, sex-linked genetic diseases, prohibit sex selection	Allowed only for medical reasons, prohibit sex selection.
Gamete donation (sperm, egg, embryo)	No person shall purchase, propose to purchase, sell, import or export sperm, an oocyte or an embryo	No person shall purchase, propose to purchase, sell, import or export sperm, an oocyte or an embryo
Surrogacy	Forbidden	Altruistic is allowed

Source: NHCPRC.; Adulyadej, 2015

First of all, the regulations make provisions for the applicable groups receiving artificial insemination, only a woman having lawful husband shall undergo artificial insemination. In China, it must also comply with national population and family planning regulations. In terms of the use of PGD and sex selection, Chinese regulations make strict restrictions on its application. PGD mainly be used for high-risk groups of children with single gene related genetic diseases, chromosomal diseases, sex-linked genetic diseases, but prohibit sex selection. In Thailand, the use of PGD is not restricted too much, and prohibit sex selection too. Gamete donation is legal in China and Thailand, but prohibit purchase, propose to purchase, sell, import or export sperm, an oocyte or an embryo. The Chinese regulation stipulates the conditions for egg donation, which is any organization or individual is prohibited to recruit egg donors in any form for commercial egg donation, egg donation is limited to the remaining eggs in the cycle of human-assisted reproductive therapy, egg donors must undergo relevant health checks, egg donors should be fully informed about the use, rights and obligations of the donated egg and sign an informed consent. In this regard, Thai regulations have not yet specified. In addition, surrogacy is forbidden in China. However, in Thailand,

surrogacy is not completely prohibited, but forbidden commercial surrogacy. The couple seeking surrogacy shall hold Thai nationality, and the surrogate mother shall not be an ascendant or a descendant of the lawful husband and wife but shall be blood relative of the lawful husband or wife. Furthermore, surrogate mother must have previously given birth to a child. Moreover, the use of embryo in surrogate was stipulated. Use an embryo formed from sperm of lawful husband and an oocyte of lawful wife intending to undertake the surrogacy or to use an embryo formed from sperm of lawful husband or an oocyte of lawful wife intending to undertake the surrogacy and other person's oocyte or sperm; provided that an oocyte of a surrogate mother shall not be used.

In addition to the above, Technical Standard for Human Assisted Reproduction also specify medical equipment, personnel requirements, and site requirements for institutions that carry out assisted reproductive technology. However, these are not found in Thai regulations. It is worth noting that Chinese regulation make quality standards for ART, for example, the annual in vitro fertilization and embryo transfer and its derivative technology implemented by any reproductive institution shall not exceed 1000 egg retrieval cycles. This is also the reason why China's assisted reproductive technology is in short supply.

Although the Chinese and Thai governments are constantly improving assisted reproductive technology regulations, the current regulations are still flawed. For example, Act et al. (2015) present that foreign couples are allowed to use surrogates under Section 21 of Protection for Children Born Through Assisted Reproductive Technologies Act, B.E. 2558, but doesn't provide suitable regulation for foreigners to use surrogates. LIqing (2015) and Jinyu (2019) expressed China's underground surrogacy market is huge, and surrogacy disputes occur frequently, China should conditionally allow surrogacy.

The regulations on assisted reproductive technologies of China and Thailand may have imperfections, but all for the protection of human interests, hope everyone can comply with the regulations.

Supply chain (SC)and efficient supply chain(ESC)

Supply chain is a system of organizations, consists of all parties involved, directly or indirectly, in fulfilling a customer request. Supply chains play a crucial role in organizations as they are responsible to guarantee product and service availability to the final consumer (Barbosa-Povoa and Pinto 2020). About its definition, many academicians give different answers. According to Janvier-James (2011), supply chain is a structured manufacturing process that converts raw materials into finished products and then delivers them to the end customer, is a chain from the beginning of raw materials to the end of finished product sales, is the process involves an organization converts raw materials into finished products and transports them to end users.

The concept of the efficient supply chain in this research comes from (Chopra and Meindl 2016). A supply chain's performance in terms of responsiveness and efficiency is based on the interaction between the following logistical and cross-functional drivers of supply chain performance: facilities, inventory, transportation, information, sourcing, pricing. While, drivers are defined in Table 6.

Table 6 The drivers defined in supply chain performance

Drivers	Define
Facilities	Actual physical location in the supply chain network where product is stored, assembled, or fabricated.
Inventory	All raw materials that work in process and finished goods within a supply chain.
Transportation	The inventory moving from point to point in a supply chain.
Information	The data and analysis concerning facilities, inventory, transportation, cost, price, and customers throughout the supply chain.
Sourcing	The choice of who will perform a particular supply chain activity, such as production, storage, transportation, or the management of information.
Pricing	Determines how much a firm will charge for the goods and services that it makes available in the supply chain.

Source: Chopra and Meindl, 2016

The structure of these drivers also affects the financial measure. Therefore, improving the supply chain surplus and the firm's financial performance can be realized through structuring these drivers to achieve the desired level of responsiveness at the lowest possible cost. **Figure 4** demonstrated a visual framework for supply chain decision making. The competitive strategy of company decides their supply chain to be, and the supply chain strategy determines how the supply chain should perform with respect to efficiency and responsiveness. Conversely, as the drivers of supply chain performance, which constitute with three logistical and three cross-functional, can affect the efficiency and responsiveness of the supply chain. Therefore, the concept of the efficient supply chain in this research is to structure these drivers to reach the performance level the supply chain strategy dictates and maximize the supply chain profits.

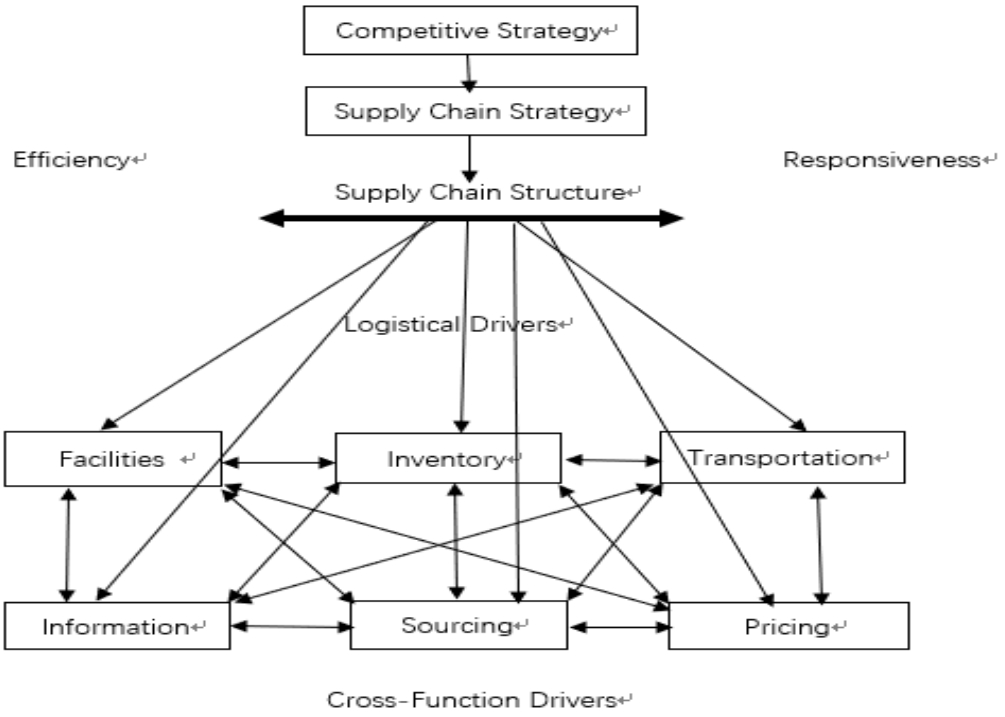

Figure 4 Supply Chain Decision-Making Framework

Source: Chopra and Meindl, 2016

Supply chain managers are analyzed mainly in the light of cost, time and quality of the customers' service delivered by the supply chain management to enhance and improve supply chain competitiveness. The quality in supply chain management is influenced both by activities undertaken in the area of customer service. How to improve service quality highlights the importance of customer experience. Holmlund et al. (2020) defined customer experience as "a customer's response to interactions with an organization before, during, or after purchase or consumption, across multiple channels, and across time", From the definition of customer experience, customer experience, as a holistic in nature, involving the customer's cognitive, affective, emotional, social, and physical responses to any direct or indirect contact with the service provider across multiple touchpoints during the entire customer journey, has emerged as a sustainable source of competitive differentiation. Customer experience is now a leading management objective, have attracted the attention of many big companies, like Amazon, and Google (Lemon and Verhoef 2016). In addition, many academic studies have also focused on the customer experience. Karaosman (2018) explored the luxury yacht industry through case studies with eight companies operating in Italy, discover that customers influence the company's operating strategy and supply chain processes, and then propose an understanding of how to translate customer expectations into supply chain decisions. Ning Jiang (2015) had analyzed the development of Web 3. 0 and the characteristics of supply chain information service, explain the requirements of the Web 3.0 environment for supply chain customer information experience, explore the sources of value creation of supply chain customer information experience in Web 3.0, emphasizes that Customer information experience value satisfaction can enhance information competitive advantage. Holmlund et al. (2020) had developed customer experience insights through analysis of customer experience data, providing a comprehensive integration framework, which can guide organizations go from customer experience data to customer experience actions for customer experience management. Nowicka (2020) had put forward the definition of customer-centric the digital transformation of the supply chains by combining customer experience in the organization with the concept of the digital supply chain. They believed that customer experience is the driving force behind the digital transformation of the supply chain. It can improve processes by meeting customer expectations,

thereby meeting the quality of service provided by the entire supply chain process. Grewal, Levy, and Kumar (2009) emphasized the role of macro factors in the retail environment and how they affect customer experience and behavior. Identified several ways to provide a superior customer experience that can increase customer satisfaction, make more frequent shopping visits, increase wallet share, and increase profits. Mihardjo et al. (2020) analyzed a sample of 35 Indonesian information and communication technology (ICT) companies, demonstrating that customer experience and distinctive capability have a significant positive impact on co-creation strategies.

These previous researches all proved the important role of customer experience in supply chain management. Therefore, as another driver of supply chain performance, customer experience should be considered.

Customer journey map (CJM)

A CJM is a widely used tool to represent user experience with a service. Customer journey is the process that a customer goes through to reach a specific goal, involving one or more service providers, typically detailed as a series of touchpoints or interactions between the customer and the service providers. Many companies successfully use it to improve existing services or develop new services. For example, eMarket company obtain a detailed overview of the service process, found user issues and gaps in the service delivery by using CJM (Haugstveit, Halvorsrud, and Karahasanovic, 2016). Oliveira, Birrell, and Cain (2020) used customer journey mapping as a design tool to understand the experiences of the train crew, revealed that two main negative touchpoints for the crew occur at the platform-train interface and during revenue protection activities. Weber (2017) considered that combined the business model and the customer journey to get a better overview of how value is created, communicated, and sustained for a certain customer segment. Følstad, Kvale, and Halvorsrud (2014) provide an overview of the different purposes and implementations of emerging involvement practices with the customer journey approach and contribute a simple framework for these practices. Shih, Chen, and Chen (2006) had developed a design process and rule sets for a CJM based on a human factors approach, then 25 categories of mobile services as case studies were conducted to develop 25 categories of CJMs. Last, they introduced passive and active methods to

generate new service opportunities and analyzed similarities among customer journey maps. Grewal and Roggeveen (2020) demonstrated CJM and understanding the role of customer experience at each stage of the journey is key to the survival and development of retailers and manufacturers in this technology-intensive environment. And highlighted that the customer journey can be both looping and nonlinear in nature and involves cognitive, emotional, and behavioral responses. Rosenbaum, Otalora, and Ramírez (2017) linked customer research to the CJM process, shows how to develop a customer journey map to improve the customer experience at each touch point. Case study reveals how customer research helps the mall's strategic management team understand which touch points are critical to the customer experience.

The components of a CJM are customer, journey, mapping, goal, touchpoint, timeline, channel, stage, experience, and multimedia. And the explanations can see in Table 7.

Table 7 The explanations of components of a CJM

Item	Explanations
Customer	The stakeholder experiencing a service
Journey	The path followed by a customer
Mapping	A process consisting of tracking and describing customers' responses and experiences when using a service
Goal	Main intention
Touchpoint	Interaction between customers and companies' products or services
Timeline	The duration of the journey from the first until the last touchpoint
Channel	The method chosen by the customer to interact with the touchpoint
Stage	A point, period, or step in a process
Experience	customers' feedback and emotions
Multimedia	Audio, video, photos, and sketches

Source: Bernard and Andritsos, 2017

The steps of the design process for CJM can divide into 4 stages, which including preparation, component development, relation definition, and opportunity discovery. Among them, the first stage contains two steps, which are make the routine list and define intentions and select the main intention. The second stage contains of three steps, which are define the phase, define the goal (set of tasks), define the tasks (set of routines), and Create new routines. The third stage contains of four steps, which are define the relationships among the goals/tasks, mark the starting and ending point of each intention, draw the dividing line between the phases. The last step is assigning pain points to each goal (Shih, Chen, and Chen, 2006). As shown in Figure 5.

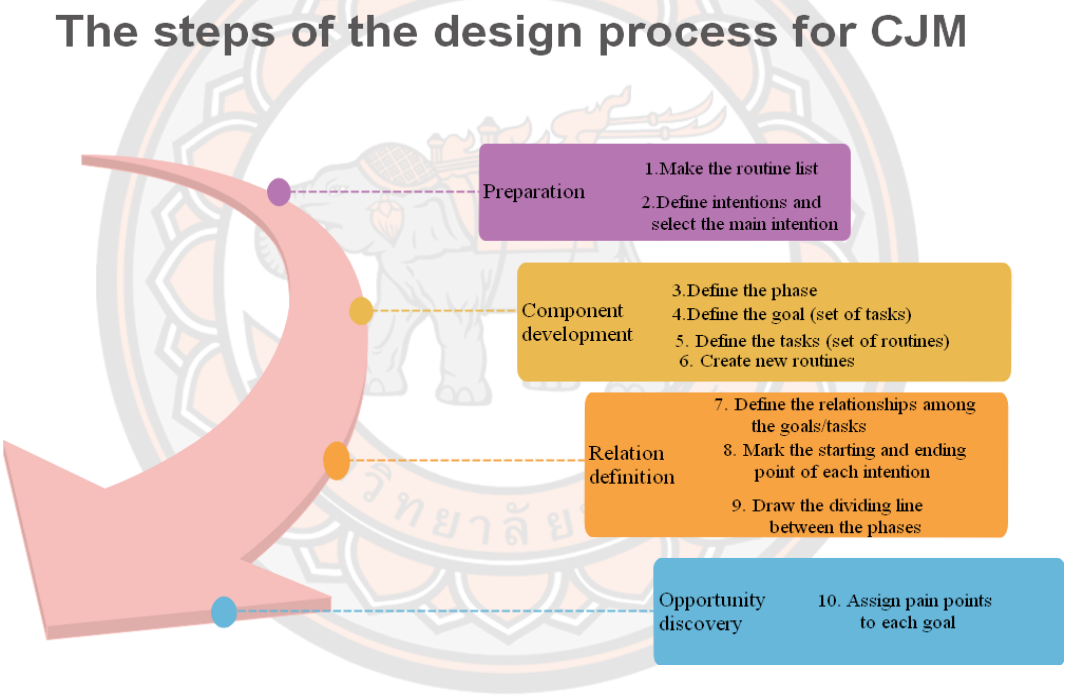

Figure 5 The steps of the design process for CJM.

CJM is an effective tool to represent user experience, especially when manager want to improve existing services or develop new services. Therefore, CJM is a suitable tool to represent the experience patients who take part in the reproductive travel.

CHAPTER III

RESEARCH METHODOLOGY

The purpose of this chapter is to reveal the research process, methodology and relevant research approaches adopted in the research. Firstly, this research determines the research field in the efficient supply chain of reproductive care by reviewing reproductive travel papers. Meanwhile, the study of supply chain performance and drivers for the efficient supply chain are reviewed. This research intends to conduct the efficient supply chain of reproductive care, so the current reproductive care supply chain will be explored at first. This research uses Chinese IVF' patient as a case study, consequently, the Chinese IVF' patient will be the interview target to explore the current reproductive care supply chain. Ultimate, the solution for solving the challenge in reproductive care supply chain will be conducted after the brainstorm, and the efficient reproductive care supply chain will be designed basic on the solution. The research methodology as shown in **Figure 6**

Qualitative method

This research used " reproductive travel", "efficient supply chain" and "ART" , CBRC as keywords to search for related precious studies of other researchers in Scopus, ScienceDirect, Google Scholar, CNKI databases respectively. After working in the literature review, the author finds the gaps in the research area which form the theme of this research. In the study of infertility patients' reproductive care experience, the author found that there are no studies Chinese infertility patients' reproductive care experience, and no studies of infertility patients' reproductive care experience from the supply chain side. Consequently, this research intends to research the efficient supply chain, using Chinese IVF' patient from China to Thailand as a case study.

Case analysis

The assisted reproductive travel, or fertility travel, reproductive travel, has become globalization, the decision to participate in fertility travel is an important life

event, which can affect all participants involved in. But there are differences when people choose reproductive travel, variation likely owing to differing cultural attitudes, traditions, religious views, and the majority's moral position. Therefore, a case study allows us more accurately to examine the situation of reproductive travel, the diverse processes involved in reproductive travel can be better understood and policymakers can be assisted to avoid what might be regarded as simplistic responses to reproductive travel.

The application of the case study approach mainly to solve explore the current reproductive care supply chain. In this section, an online questionnaire was conducted with Chinese IVF' patient, who have finished their treatment in Thailand. Furthermore, the challenges of patients will in the study, which can be the information to solve the problem.

Online questionnaire

Due to the impact of COVID-19 worldwide, our working mode becomes work from home. Thus, an online questionnaire was conducted on the wjx.cn. This popular website was created for supporting to sustain research in different academic fields, that can deliver to the participant, who participate in this survey voluntarily. The link of the online questionnaire has been distributed via WeChat, a social software with more than one billion users. The questionnaire is anonymous, and participants complete surveys voluntarily, the questionnaire took approximately 15 minutes to complete.

Sample

Although CBRC is a growing phenomenon, rare people are known about its actual magnitude and scope around the globe. In order to achieve the results of the Chinese patient's opinion, a qualitative and descriptive, non-probability sample of Chinese residents who had been to go to Thailand for fertility treatment was accessed. Accidental sampling will be used to develop the sample size. And the respondents were all from mainland China, are men or women 20 years or older, because the legal marriage age in China is 20 years or older.

Data

The content of the questionnaire focused on the following areas: (1) socio-demographic profile,(2) reproductive treatment experience in Thailand, (3) type of treatment and motivations for traveling to Thailand, (4) evaluation of clinical care

service and satisfaction during treatment. Evaluation of clinical care service was rated on attitudinal Likert scales (e.g., 1= strongly agree to 5 = strongly disagree), (5) The challenges or barriers for Chinese patients' reproductive travel in Thailand.

Comparative analysis

A comparative analysis is a type of analysis used in various sciences, intend to distinguish things by comparing the similarities and differences between things. Comparative analysis is divided into horizontal comparison and vertical comparison. Horizontal comparison is to compare related things in the same period to find the difference between the two types of things, and then analyze the reasons for this difference. Vertical comparison is to compare the specific characteristics of the same object in different periods to reveal the characteristics of the cognitive object at different stages in different periods and their development trends.

This research adopts a comparative analysis method to compare the differences between the cost, time and patient experience in the current supply chain, scenario 1 and scenario 2, which are detailed in Chapter IV. The purpose of comparison aims to identify which one is the efficient assisted supply chain.

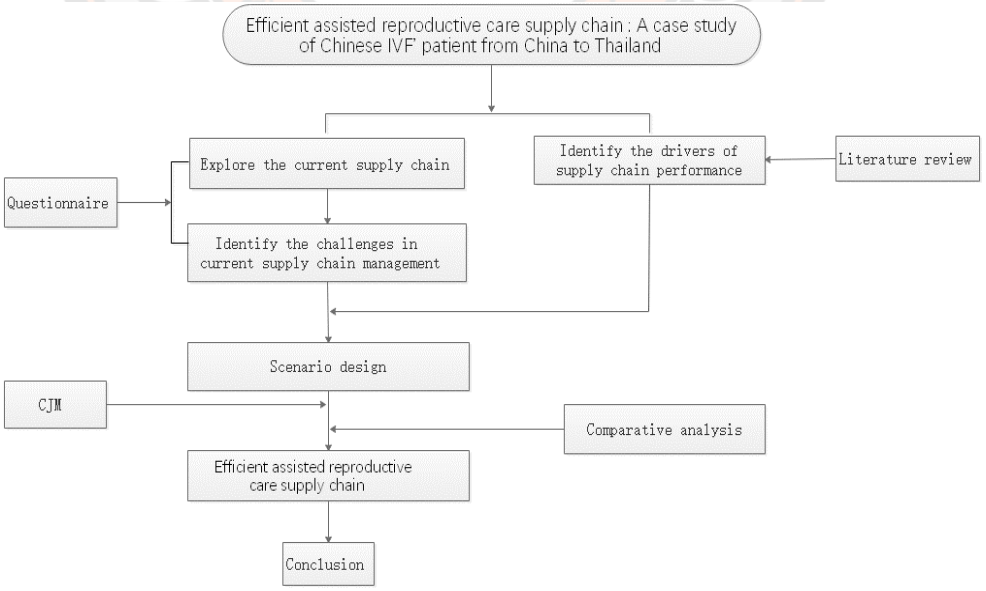

Figure 6 Research Methodolog

CHAPTER IV

RESULTS AND DISCUSSION

This chapter aims to illustrate the basic situation of the case in this research, based on empirical research. This research selects Chinese patients who pursue reproductive treatment in Thailand as the case study, therefore, the demographic profile of the case will be revealed at first. Furthermore, the reproductive travel experience of Chinese patients in Thailand will be described. Moreover, types of treatment that Chinese patients looking for in Thailand are demonstrated. In addition, the motivations for reproductive travelling of Chinese patients in Thailand will be indicated.

Case analysis

Demographic profile

The sample size of this study has been a total of 51 participants, all of the samples are Chinese patients who had already completed their fertility treatment in Thailand, included 43 female and 8 males. Nearly 90% of them are married, and half of the participants already have children before treatment. The average age of the participants is 32.43 years, 84% are the first time to go abroad for assisted reproductive treatment. Their overall education level is not too high, mainly engaged in freelance and general administrative work. As for monthly income, the average monthly income of participants concentrated within 30,000 Yuan. Specific demographics, like sample numbers and proportion, are given in **Table 8.**

Table 8 Demographic profile of participants: Chinese patients

Characteristic	N	%
Gender		
Female	43	84.31
Male	8	15.69

Characteristic	N	%
Marital and nurture status		
Married and have children	31	60.78
Married and no children	14	27.45
Unmarried	6	11.77
Educational status		
Secondary level	28	54.90
Graduate	17	33.33
Post-graduate	6	11.77
Occupation		
Staff	11	21.57
Senior management	10	19.61
Civil servant	4	7.84
Entrepreneur	7	13.73
Student	2	3.92
Freelance	17	33.33
Average monthly income (Yuan)		
Within ten thousand	21	41.18
Ten thousand to Twenty thousand	14	27.45
Twenty thousand to Thirty thousand	8	15.69
Over thirty thousand	8	15.69

Reproductive travel experience of Chinese patients in Thailand

For the experience of Chinese patients, the results show that patients who are participants in the online questionnaire will search for assisted reproductive treatment information from multiple sources when they suffer from infertility. On the one hand, most of the participants are willing to accept recommendations from an acquaintance (52.94%). However, the number of participants, who choose large authoritative hospitals for consultation are quite a lot (35.29%). In addition, 70% of participants will reserve one month for treatment. When on the journey for fertility travel, 58.8% of participants choose to find arranging service personnel, the services were provided by the professional medical service agency which are very extensive and cover almost all

activities of patients. The activities consist of the arrangement accommodation and food, ticket agent, visa agent, doctor appointment, medical records, translation service, pick-up service and drop off service. Moreover, 16.13% of participants choose to arrange their own itinerary, and 25.81% of participants are accompanied by family and friends to Thailand for treatment.

The reproductive travel trajectory of Chinese patients in Thailand is as shown in **Figure 7**. Patient select an agency for consultation and reach an agreement after getting enough information. After that, the patient will do a medical examination and the results will be sent to a Thai expert for diagnosis. Meanwhile, the patient's visa application is also arranged. After the preliminary preparations were completed, the patient flew to Thailand for treatment. When arriving in Thailand, Chinese patients will undergo the first stage of treatment. If everything goes well, Chinese patients will return home and re-travel to Thailand for the second stage of treatment at the right time. Until the treatment is completed and the pregnancy is confirmed, Chinese patients return home. Both medical and travel services are existing in the whole trajectory of Chinese patients, the combination of the two is shown in **Figure 8.**

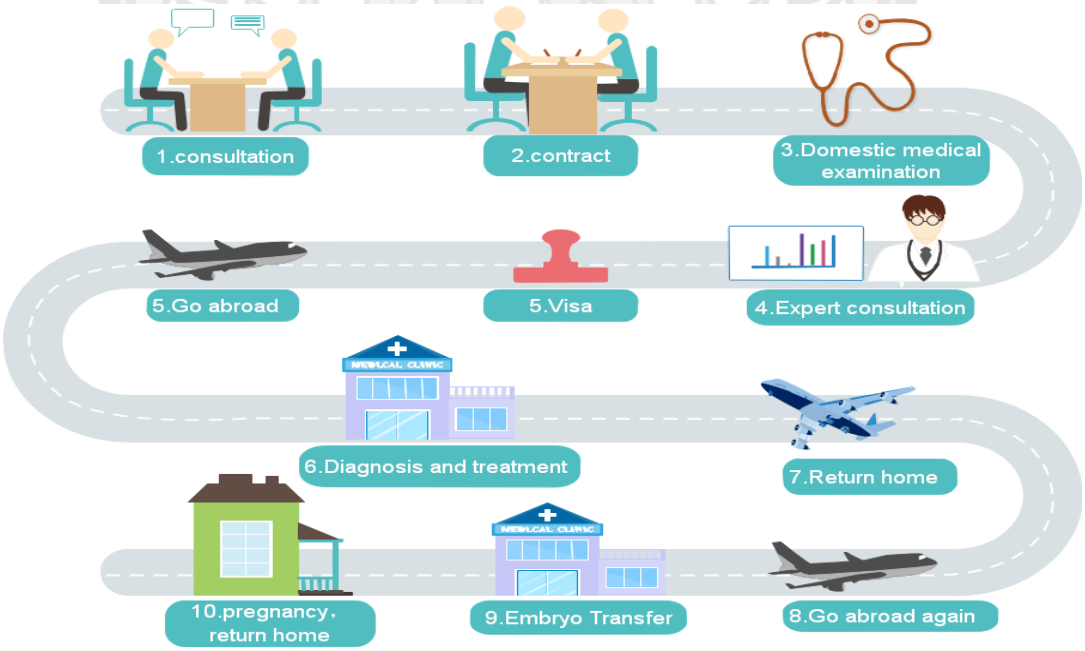

Figure 7 The reproductive travel trajectory of Chinese patients in Thailand

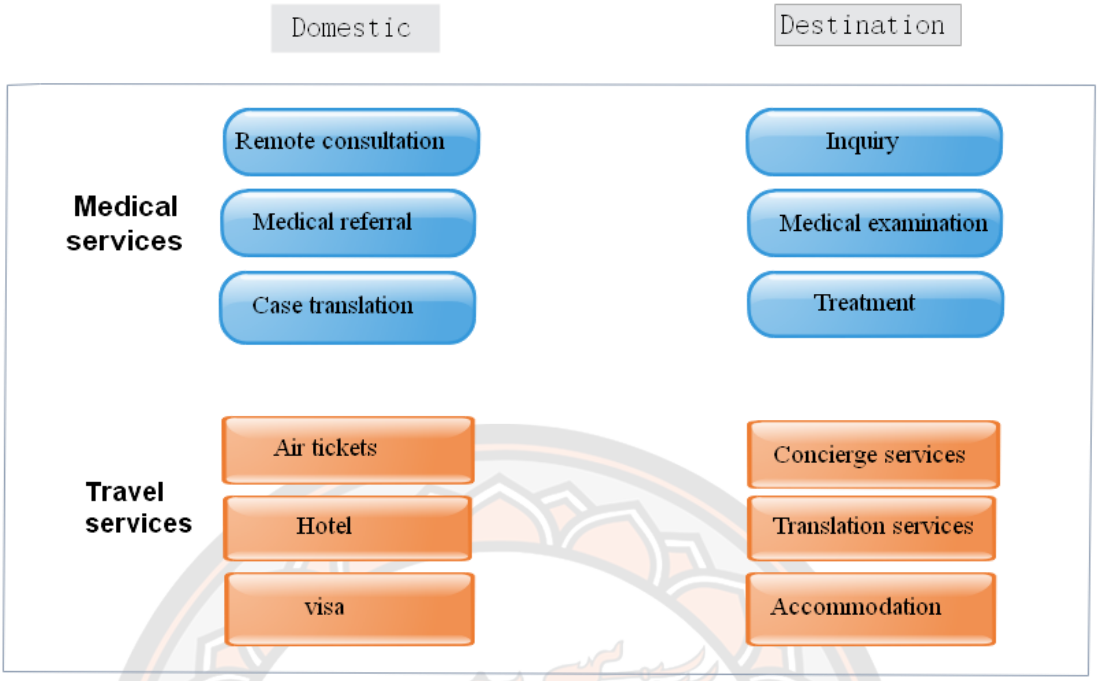

Figure 8 The flow chart of cooperation between medical services and travel services in reproductive travel of Chinese patients

The types of treatment that Chinese patients looking for in Thailand

In terms of experienced treatment in Thailand, in this part was related to the kind of treatment was received, nearly 80% of participants indicate that they have accepted IVF treatment, which using their own gametes, other than that, Preimplantation genetic diagnosis (PGD/PDS) treatment also is a hot spot that attracted 29.03% of participants. The proportion of other treatments is fertility preservation (22.58%), intracytoplasmic sperm injection (ICSI) (12.90%), surrogacy 9.68%, IVF donor oocyte 6.45%, IVF/IUI donor sperm 3.23%. intracytoplasmic sperm injection (ICSI) (12.90%), surrogacy 9.68%, IVF donor oocyte 6.45%, IVF/IUI donor sperm 3.23%. In western countries, the shortage of resources in third party reproduction will be the motivation for pursuing treatment overseas, the study of Hoof, Pennings, and Sutter (2015) provides evidence. For Chinese patients, third party reproduction is not popular. This may be influenced by traditional Chinese culture, Chinese people pay attention to blood heritage, so they are more inclined to have children by using their

own gametes. The graph in Figure 9 is shown the mentioned proportion for the kind of treatment that participants used to treat in Thailand.

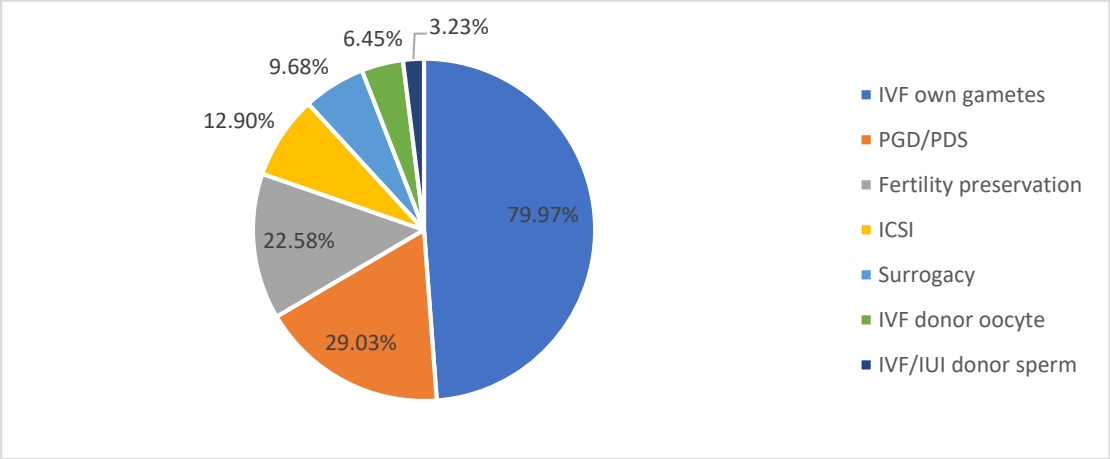

Figure 9 The types of treatment that Chinese patients looking for in Thailand.

Notes: IVF: In vitro fertilization; PGD: Preimplantation genetic diagnosis PDS: Preimplantation genetic screening; ICSI: Intracytoplasmic sperm injection IUI: Intrauterine insemination

Motivations for reproductive travelling of Chinese patients Thailand

Motivations of Chinese patients are illustrated in Table 9. This table shows the motivation factors for making the decision of participants about fertility travel in Thailand. Based on the results that are shown in the table, primary motivating factors for participants comprise of higher success rate in Thailand, good medical technology and services in Thailand, sex or trait selection, the long treatment waiting list in own country, and privacy—not wanting others to know about treatment.

The satisfaction of clinical care service in Thailand

For the satisfaction of clinical care service in Thailand, the author mainly studies from the following aspects: preparation work of Thai clinic, the accurate information, easy access to treatment, the professionalism of the medical staff, achieving with patient treatment needs, achieving with expectations for treatment, would not hesitate to recommend this clinic to others. The satisfaction of clinical care

service in Thailand are shown in Table 10, the average scores of participants are mainly distributed in strongly agree and agree.

Table 9 Motivations for Chinese patients pursue treatment in Thailand

Motivation item	N	%
Long treatment waiting list in own country	14	27.45
Treatment not permitted by law in own country	9	17.65
Gamete shortage in own country	2	3.92
Privacy—not wanting others to know about treatment	13	25.49
Thailand has a higher success rate	32	62.75
Treatment is cheaper in Thailand	7	13.73
Sex or trait selection	17	33.33
Good medical technology and services in Thailand	23	45.10

Table 10 The satisfaction of clinical care service in Thailand

Item	Sample (n)	Strongly Agree %	Agree %	Neutral %	Disagree %	Strongly Disagree %
Thailand clinic adequately prepared you for treatment	51	54.9	39.22	5.88	0	0
The information prepared by the Thailand clinic is consistent with your previous understanding	51	50.98	45.10	3.92	0	0
Easy to obtain treatment in Thailand	51	52.94	43.14	3.92	0	0
Thailand clinic had	51	54.9	41.18	3.92	0	0

Item	Sample (n)	Strongly Agree %	Agree %	Neutral %	Disagree %	Strongly Disagree %
professional counseling services available during treatment						
Thailand clinic satisfied your overall medical needs	51	52.94	43.14	1.96	1.96	0
Thailand clinic satisfied your overall expectations for treatment	51	54.9	41.18	1.96	1.96	0
You would not hesitate to recommend this clinic to others	51	56.86	35.19	7.84	0	0

Table 11 The challenges or barriers for Chinese patients' reproductive travel in Thailand

item	N	%
Difficult to obtain effective and reliable expert information	7	13.73
Expert resources are low, waiting time for treatment is too long	6	11.77
Expense is high	5	9.8
Privacy is not protected	0	0
High pressure and tight time	23	45.10
Language	10	19.61
Other	0	0

The results of patients investigate as shown in Table11, high pressure, tight time and language are the main challenges or barriers. In fact, this is not difficult to

understand. In the previous chapter, case study, we revealed the demographic profile of participants. Most of them have fixed jobs, long absences from work are risky for them, this undoubtedly caused psychological pressure on them. Furthermore, their education level is not high, unable to communicate with doctors in international languages. Thus, they think language is a challenge or obstacle. However, when patients cannot improve their international language level, hiring a translator is the best way to solve the problem. Furthermore, medical agency practitioners(4), nurses(2) and doctors(2) were investigated. When asked what the main overall challenges or barriers in your practice work procedure are, medical agency practitioners think the current cooperation model is perfect, the development of information communication technology(ICT) provides a platform for efficient communication between various departments in the entire industrial chain, many problems were promptly communicated and resolved when they were discovered. In addition, now is the information age, a lot of information can be found on the Internet. This kind of information transparency is actually helpful for maintaining the relationship between us and customers. If really say there are challenges / obstacles, they think maintaining customer relations is the biggest challenge. Engage in this industry, they think reputation is the most important, thus, providing customers with personalized services is their driving force for continuous innovation. In terms of medical care providers, current cooperation model makes them feel comfortable. The medical agency team can share some professional consulting work for them, treatment arrangements are also connected with the medical agency team, reduced barriers in communication with patients.

In conclusion, although the stakeholders are satisfied with the performance of the current supply chain, for patients, high pressure and tight time are the challenges. Based on this situation, the following content will give solution suggestions.

The current supply chain structure

Base on the reproductive travel experience of Chinese patients in Thailand, we understood the diverse processes involved in the reproductive travel of Chinese patients in Thailand and the main stakeholders in the supply chain. Thus, there presents the current supply chain for Chinese patients' reproductive travel in Thailand. From the reproductive travel experience of Chinese patients in Thailand, the author found the

other stakeholders involved in the current supply chain for Chinese patients' reproductive travel in Thailand. Through the roles played by stakeholders, the author outlines the current supply chain structure, as shown in **Figure 10.** This supply chain structure connects all suppliers that deliver tourism products and services to Chinese patients. As the ultimate consumer of tourism products and services and medical services, Chinese patient is an important part. Further, suppliers in this supply chain, on the one hand, obtain certain benefits by providing certain products and services that match consumer' needs, on the other hand, the performance of each service suppliers in the supply chain depends on the performance of other suppliers. Customer experience depends on the quality of all these services. From the structure of this supply chain, the main subjects involved include various types of tourism service providers, tourism retailer, medical intermediary company, other tourism media, such as Internet website, Thailand hospital or clinic, and Chinese patients. Under different environmental backgrounds, they will form different combination methods and different combination relationships, thereby forming a dynamic and multi-level, multi-structure network chain relationship. Medical intermediary company supply tourism product and service for Chinese patients by cooperating with tourism retailer and other tourism media or destination organization, further, supply medical arrangement for Chinese patients by cooperating with the hospital or clinic in Thailand.

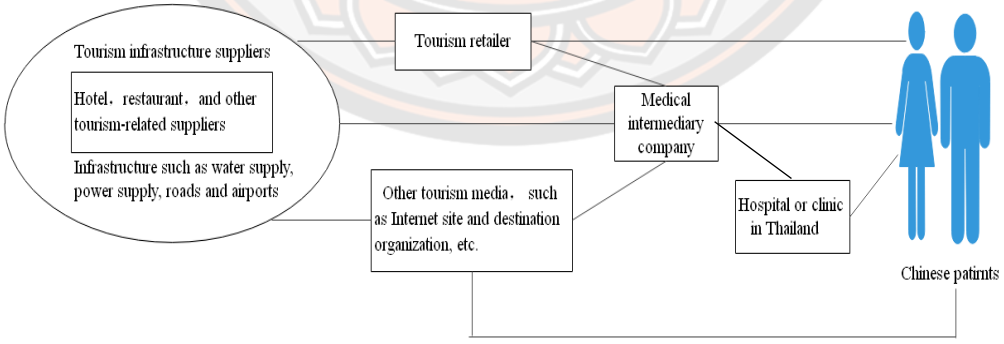

Figure 10 The current supply chain structure of Chinese patients' reproductive travel in Thailand

Time and cost analysis

Generally speaking, one treatment cycles contains three stages, including preparation, ovarian stimulation and embryo transfer shown in Table 12. The time is calculated from the patient who decides to go to Thailand for treatment, which is from the moment that patient signs an agreement with an intermediary company. After that, the patient needs a routine examination, the result will be sent to the Thai expert in an electronic form. That expert will evaluate the results- whether the patient is appropriate to travel to Thailand for treatment. The intermediary company began to prepare the procedure for the patient after getting the expert's reply, such as air ticket booking, visa application, accommodation reservation, concierge service arrangement, ensure that female patients can go to Thailand on the second day of menstruation. This stage is called the preparation stage, take more than 30 days. The patient will enter the second stage of treatment after arriving in Thailand, this stage of treatment is called ovarian stimulation. According to the scope of this research, the diel of the treatment process not included in the survey, but exists as a whole, the same is the third stage. The treatment time of the second stage, including the time on the road, usually takes about 16 days. After finishing the treatment of this stage, patients can choose whether to return to China or not. There is a blank period between the second and third stages for experts carry out embryo breeding. The treatment of the third stage is called embryo transfer, will take about 12 days. After confirming a successful pregnancy, the patient can return to China. The schedule of Chinese patients' reproductive travel is ended.

Table 12 The schedule of Chinese patients' reproductive travel in Thailand

item	Number	Unit
The first stage: preparation	≥30	Day
The second stage: ovarian stimulation	16	Day
The third stage: embryo transfer	12	Day
Total	≥58	Day

Table 13 The cost of Chinese patients' reproductive travel in Thailand

item	Cost	Unit
Medical fees	101,000-125,000	Yuan/Treatment
Ticket fees	2,000-5,000	Yuan/trip
Visa fees	300	Yuan/time
Transportation, accommodation and food fees	50,000-100,000	Yuan/trip
Translation service fees	8,000-10,000	Yuan/trip
Total	167,300-300,300	Yuan

Cost of IVF Program at BNH 试管婴儿收费表

第一阶段：进行试管婴儿治疗前检查 Preparation part

	项目	*費用(泰銖 Baht)*
1.1	常规验血测试 (Routine blood work): 血常规,血型,正负血型,血红蛋白,艾滋,梅毒,乙肝抗原,丙肝抗体,风疹抗体 CBC,BI gr, Rh gr, Hemoglobin typing, Anti HIV, VDRL, HBsAg, Anti HCV, Rubella IgG	9,500 ฿
1.2	月经第二天激素检查:促卵泡生成素,促黄体生成素,雌二醇,催乳素及抗穆勒氏管激素 Blood test for hormones FSH, LH, E2, PRL on day 2 of period and AMH	9,000 ฿
1.3	月经第十二天的阴超检查 Transvaginal ultrasound on day 12 of period	3,700 ฿
1.4	精液分析 Sperm count	2,500 ฿
	精子 DNA 碎片率 DFI	5,000 ฿
	精子冷冻年费 Sperm freeze annual fee	4,500 ฿

第二阶段：促排卵部分 Ovarian stimulation part

	项目		*費用(泰銖 Baht)*
2.1	降调药物 Drug used for down regulation		
	布舍瑞林喷鼻药 Suprefact E nasal spray	或 or	4,650 ฿
	注射用醋酸西曲瑞克 Cetrotide 0.25mg	或 or	4,300 ฿
	醋酸加尼瑞克注射液 Orgalutran 0.25mg		3,250 ฿
2.2	8 天促排卵药物 (用药种类,剂量,天数视病人情况而定) Drug used for ovarian stimulation:**for 8 days		
	• 果纳芬,300 单位/天 Gonal F 300 units / day	或 or	81,824 ฿
	• 普丽康, 200 单位/天 Puregon 200 units / day	或 or	56,560 ฿
	• 倍孕力,300/150IU/天 Pergoveris 300/150IU / day	或 or	97,840 ฿
	• 重组人卵泡刺激素, 300IU/天 Follitrope 300IU / day		72,000 ฿
2.3	释放排卵的药物 Drug used for trigger ovulation		
	• hCG 5000 units	或 or	2,750 ฿
	• 克得诺 Ovidrel 250 mcg	或 or	3,400 ฿
	• 注射用醋酸曲普瑞林 Diphereline 0.2 mg		4,700 ฿
2.4	阴超监测卵泡发育 Ultrasound scan monitoring follicular growth		3,700 ฿

第三阶段：取卵和实验室 项目 IVF laboratory part

	项目	*費用(泰銖 Baht)*
3.1	取卵手术及胚胎培养 Oocyte retrieval and embryo culture	130,000-150,000 ฿
3.2	胚胎移植前染色体筛选 Preimplantation Genetic Test	
	PGT-NGS (5 对染色体，1-8 个胚胎) 5 Chromosomes, 1-8 embryos	100,000 ฿
	PGT-NGS (全部染色体检查，1-4 个胚胎) 24 Chromosomes, 1-4 embryos	90,000 ฿
	PGT-NGS (全部染色体检查，5-8 个胚胎) 24 Chromosomes, 5-8 embryos	140,000 ฿
	PGT-NGS (全部染色体检查，超过 8 个胚胎后) 24 Chromosomes, extra embryos	25,000 ฿/embryo
3.3	胚胎移植 Embryo transfer	70,000-80,000 ฿
3.4	胚胎冷冻年费(10 管内)Embryo freezing 1 year, 10 straw	20,000 ฿
	胚胎冷冻,超过 10 管后 Embryo freezing >10 straw	2,000 ฿/straw
3.5	取精手术(无精症) Surgical retrial of sperm in case of Azoospermia (PESA/TESE)	60,000-70,000 ฿
	精子磁筛(精子 DNA 碎片率异常) MACs Sperm	20,000 ฿

黄体支持期：Luteal Support program

	项目	*費用(泰銖 Baht)*
4.1	快孕隆 Crinone 8% gel (每支)	370 ฿
	安琪坦 Utrogestan 200mg (每粒)	53฿
4.2	普罗路通注射剂 Proluton Depot 250mg (每支)	650฿
4.3	保健宁 Pregnyl 1500 units i.m. (每支)	1,700฿
4.4	达芙通 Duphaston 10mg tab (每粒)	46 ฿
4.5	补佳乐 Proynova 2mg (每 28 粒)	288฿
	Postmenop 2mg (每 30 粒)	420฿

Figure 11. The cost of IVF program at BNH hospital

Source: BNH hospital

The costs of current supply chain for Chinese patients' reproductive travel in Thailand consists of five parts, which are medical fees, ticket fees, visa fees, transportation, accommodation and food fees, and translation service fees as shown in Table 13. As for the breakdown of medical fees, this research takes BNH Hospital as an example, shown in Figure 11. Thus, if all goes well, the total cost for one cycle is probably 170,000-250,000 Yuan. Since assisted reproductive treatment is special, the fees are not fixed. Different patients have different physical condition, so the treatment plan is different for everyone, and led to different treatment cycles.

Based on the high pressure, tight time and language are the main challenges of Chinese patients' reproductive travel, this research attempts to give two scenarios to alleviate these challenges to improve the patient experience.

Scenario 1: Add suppliers on the basis of the structure of the current supply chain. As shown in Figure 12.

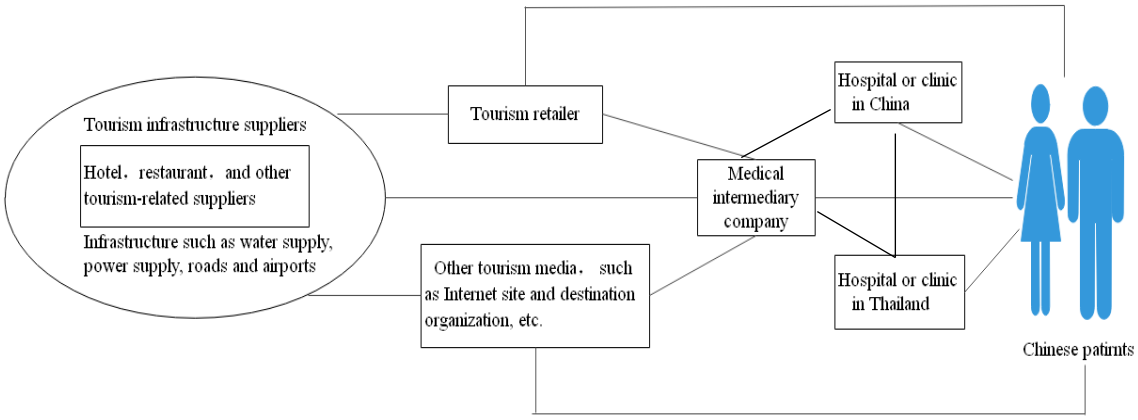

Figure 12. The supply chain structure of Scenario 1

As previously analyzed, the most of patients in this research have fixed jobs, can't absent from work for long. Thus, the scenario 1 is to reduce the patient's time in Thailand by adding china hospital or clinic as a new supplier. It means that Chinese experts participate in treatment service provision. It needs medical intermediary company, Chinese experts, and Thai experts to work together. The aim is to move the treatment of the second stage from Thailand to China. Chinese experts and Thai experts

cooperate to discuss treatment options, to promote patients to complete treatment. Thai experts should maintain communication with Chinese experts, follow up patient treatment, so that the treatment of the third stage can proceed smoothly. The role of the medical intermediary company is to coordinate the relationship between the three-Chinese experts, Thai experts and Chinese patients, ensure the treatment of each stage can be seamlessly connected. The adding in supplier seems to make the structure of the supply chain more complicated, but it can make the patient's schedule more flexible. Patients can consider work by changing the structure of the supply chain, reduce absent working hours.

Time and cost analysis

Adding a supplier does not reduce treatment time, but it can enhance the patient's control of time, relieve patients' stress. Therefore, time of Chinese patients' reproductive travel doesn't change in quantity. As shown in Table 14.

Table 14 The schedule of Chinese patients' reproductive travel in scenario 1

item	Number	Unit
The first stage: preparation	≥30	Day
The second stage: ovarian stimulation	16	Day
The third stage: embryo transfer	12	Day
Total	≥58	Day

As for the cost, the treatment cost won't change much, the main changes will occur in transportation, accommodation and food fees. The proposal of Scenario 1 is to facilitate patients to go to the nearest hospital for medical treatment, so as to take care of work. In this case, patient live at home, no need to arrange additional accommodation. Thereby reducing the cost of transportation, accommodation and food. According to the national bureau of statistics, In the first quarter of 2020, per capita consumption expenditure of Chinese residents is 5082 Yuan, if calculated by this standard, consumption expenditure of Chinese patient in the second stage is 2710 Yuan. And the cost of transportation, accommodation and food in third stage 21,428-42,857 Yuan. Therefor the cost of Scenario 1 as shown in Table 15

Table 15 The cost of Chinese patients' reproductive travel in Thailand Scenario 1

item	Cost	Unit
Medical fees	101,000-125,000	Yuan/Treatment
Ticket fees	2,000-5,000	Yuan/trip
Visa fees	300	Yuan/time
Transportation, accommodation and food fees	24,138-45,567	Yuan/trip
Translation service fees	8,000-10,000	Yuan/trip
Total	141,438-200,867	Yuan

Scenario 2: Reduce stakeholders on the basis of the structure of the current supply chain. As shown in Figure 13.

The aim of this scenario is to let patients avoid travelling abroad, but the Thai experts travel to China to afford the treatment. In this scenario, Thai experts go to the Chinese hospital for a consultation, supply medical services for Chinese patients. In this way, Chinese patients can obtain technical treatment from Thai experts by avoiding traveling abroad. Without the arrangement of intermediary companies, Chinese patient can get information in hospital or clinic and arrange treatment travel by them self.

In terms of time schedule, as shown in Table 16. The cycle time of IVF is affected by many factors, therefore, there is no accurate time. However, the cycle time of ovarian stimulation and embryo transfer is accurate, ovarian stimulation is about 12 days and embryo transfer is about 12 days.

As for cost, in China, the cost of treatment for IVF is about 50,000-60,000 Yuan, cheaper than Thailand. As for other cost, patients can choose the form of self-help, the specific amount will vary from person to person. Here is calculated according to per capita consumption expenditure of Chinese residents in the first quarter of 2020, which is 5082 Yuan. As shown in Table 17.

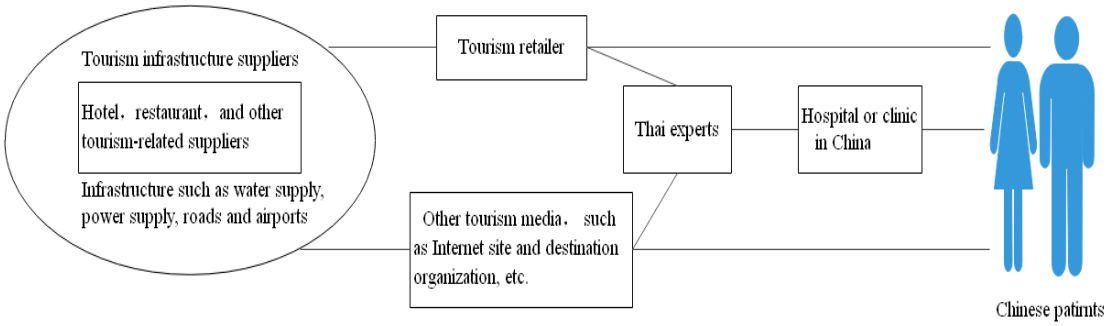

Figure 13 The supply chain structure of Scenario 2

Table 16 The schedule of Chinese patients' reproductive travel in scenario 2

item	Number	Unit
The first stage: preparation	≥30	Day
The second stage: ovarian stimulation	12	Day
The third stage: embryo transfer	12	Day
Total	≥54	Day

Table 17 The cost of Chinese patients' reproductive travel in Thailand Scenario 2

item	Cost	Unit
Medical fees	50,000-60,000	Yuan/Treatment
Transportation, accommodation and food fees	5,082	Yuan/trip
Translation service fees	8,000-10,000	Yuan/trip
Total	63,082-75,082	Yuan

Comparative analysis

Time and cost comparative between current, Scenario 1 and Scenario 2

As mentioned before, IVF cycle time is affected by many factors, thus there is no accurate time for IVF treatment. However, the cycle time of ovarian stimulation and embryo transfer is accurate, how many cycles need to be done in practice depends on the patient's physical condition and the expert's treatment plan. Therefore, the time

given in this research is estimated. In this way, there seems to be no difference in time arrangement between the three. However, in terms of time flexibility, there is still a difference between the three. The current one, the patient's time will be controlled by the entire treatment, at the same time, being abroad makes them forced to absence from work for long. Scenario 1 transfer the treatment of second stage from Thailand to China, which can increase the patient's time control in the second treatment stage. As for Scenario 2, IVF treatment cycle schedule in China, patients can coordinate treatment time with doctors according to their own situation, this is the best choice for patients with fixed jobs. As for cost, the cost of Scenario 2 lowest, and then is Scenario 1, the cost of current is highest, as shown in Figure 14

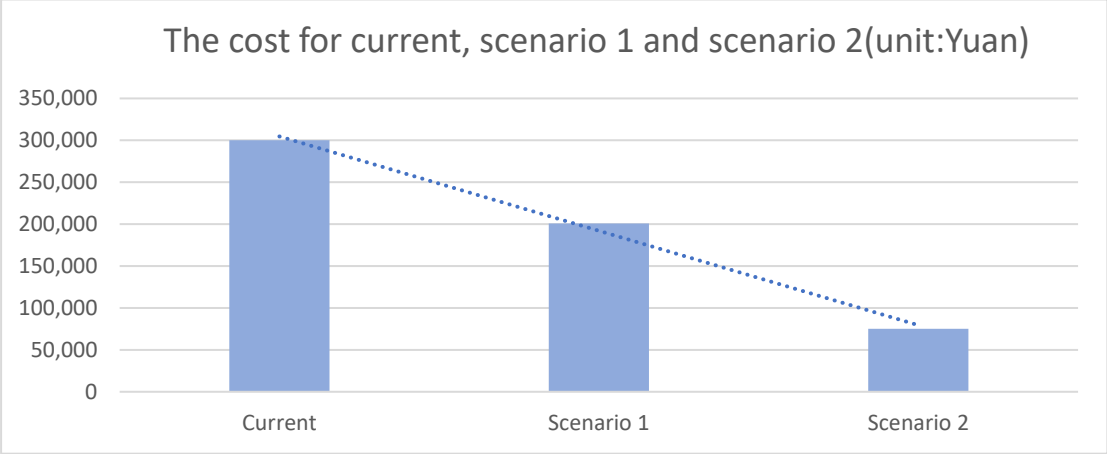

Figure 14 The cost for current, scenario 1 and scenario 2

To summarize, comparing time flexibility and cost, scenario 2 is the best choice.

Customer experience comparison

In addition to comparing time flexibility and cost, the customer experience of three forms will also compared. Supply chain competitiveness concentrates mainly on cost, time and quality improvement. We have analyzed the time and cost in the previous section, below we analyze from the quality of the supply chain. It is worth noting that the quality in supply chain management is influenced both by activities undertaken in the area of customer service, thus customer experience is a driver of

supply chain quality. A customer journey map (CJM) is a widely used tool to represent user experience with a service. Here, customer journey map is used to describe the journey of three forms.

First of all, the goal of the journey is identified. From the motivations for Chinese patient to take part in the reproductive travel from China to Thailand, higher success rate, good medical technology and services, sex or trait selection, the long treatment waiting list in own country, and privacy—not wanting others to know about the treatment were identified. Thus, the goal of the journey defined to fulfilling the desire for pregnancy by obtaining good medical technology and services in a short time and can select the sex or trait of embryo.

Further, the stages of journey are defined by following the treatment schedule, which are preparation, ovarian stimulation and embryo transfer. Based on previous survey, customer journey map of three forms are conductive, as shown in Figure 15, Figure 16 and Figure 17.

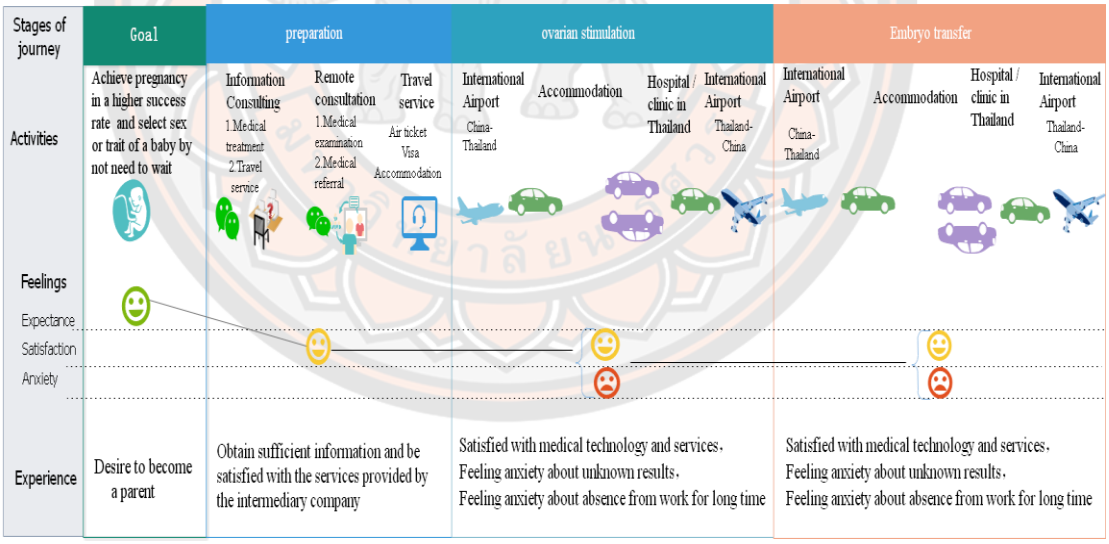

Figure 15 The current customer journey mapping of Chinese patient

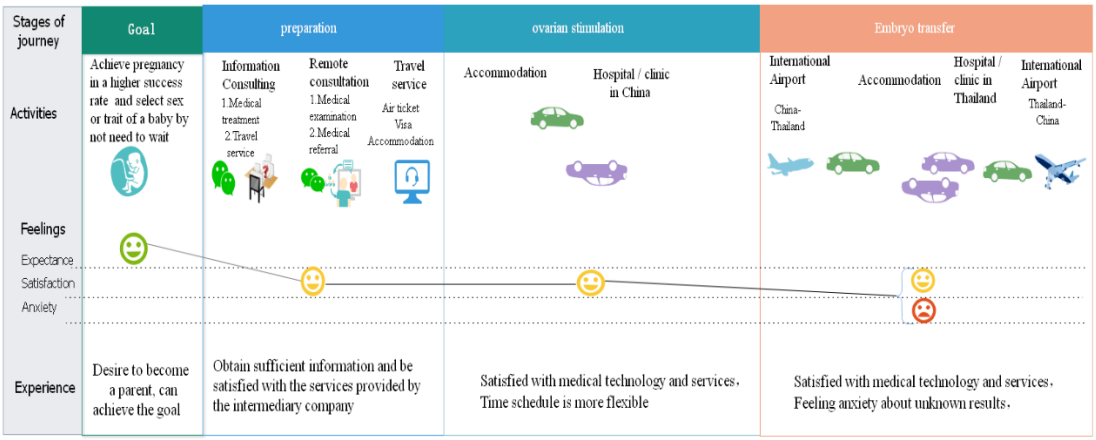

Figure 16 The customer journey mapping of scenario 1

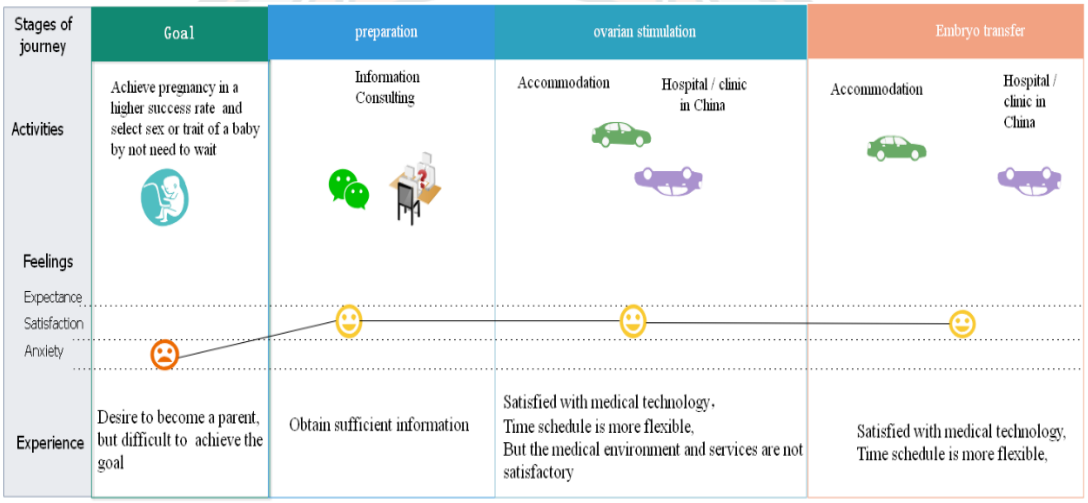

Figure 17 The customer journey mapping of scenario 2

Through the comparison of three customer journey maps, we discover, there are many departments in contact with patients, especially the current customer journey, and the transportation multi- transportation mode will increase the time. As mentioned before, the proposal of scenario 1 and scenario 2 is to reduce the treatment time of Chinese patients in Thailand, so that they can control their time more flexibly and take care of their work. From Figure 15 and Figure 16, patient satisfaction will increase. However, in achieving the goal, scenario 2 cannot fully meet the goals of patients. Chinese long for both sons and daughters, having a son and daughter is a blessing, they two will make a “hao” (good), therefore, participants in this study deliver a strong desire for sex or trait selection. Sex or trait selection depend on PGD

technology. In China, the use of PGD technology has very strict requirements, the application process is complicated, only special groups, like the people suffering from familial genetic disease are allowed to use. On the other hand, a practical problem that is not shown on the picture is waiting time to access treatment. China has strict control over the number of IVF cycles; thus, the reproductive treatment market is in short supply in China. Selecting scenario 2 may face long waiting list. Therefore, scenario 1 is more efficient.

CHAPTER V

CONCLUSION AND FURTHER WORKS

With the development of globalization in healthcare, medical tourism is a rising global phenomenon in the 21st century. One category of cross-border medical tourism, cross-border reproductive care (CBRC), colloquially known as reproductive tourism or fertility tourism, has been developed rapidly. At the moment, CBRC becomes a worldwide phenomenon. However, the globalization of CBRC also raises many questions, which attracted intense discussion. While, these discussions do not include discussions on supply chain management perspective. In addition, China's 40 years of reform and opening-up have brought population problem, to solve the population problem, Chinese government introduced a universal two-child policy in 2016. However, China's assisted reproductive market is in short supply. Therefore, a lot of Chinese patients go abroad looking for assisted reproductive treatment recently.

Based on the above background, this research proposes an efficient supply chain for reproductive travel in studying the current supply chain structure for reproductive travel and identified the challenges basically by using Chinese patients who looking for treatment in Thailand as a case study. Firstly, the treatment-experienced, motivation and satisfaction of Chinese patients have been explored by using an online questionnaire, in order to be better understood the diverse processes involved in reproductive travel and the challenge in experience. The finding shown that the employees with fixed jobs are the most participants, they tend to outsource their travel arrangement to medical intermediary company, and they are satisfied with their journey. Moreover, high pressure and tight time were identified to be the challenges in reproductive travel. Finally, based on the concept efficient supply chain of Chopra and Meindl (2016), this research restructured the supply chain structure in order to solve challenges in the current supply chain management. Scenario 1: Add supplier-China hospital or clinic on the basis of the structure of the current supply chain, move the treatment of second stage from Thailand to China. Scenario 2: Reduce stakeholders on the basis of the structure of the current supply chain. Medical intermediary company

remove from the supply chain structure, Thai expert move to China to give the treatment. Further, time, cost and patient experience are compared. The results demonstrate that Scenario 1 and Scenario 2 both relieves the patient's time constraints, reduce the cost. However, in terms of customer goals, Scenario 1 can fulfill the patient's goal, Scenario 2 is difficult to fulfill the patient's goal. Therefore, Scenario 1 is more efficient.

In addition, it is worth noting out that Thai law does not restrict the use of PGD technology, but it is absolutely prohibited to sex selection. PGD technology can screen out genetic diseases, improve the success rate, and let us have healthy babies. Therefore, when using PGD technology, we shall comply with the assisted reproduction regulations of Thailand.

Further works

There are some limitations in this research as follow. First of all, Influenced by COVID-19, the main source of the data in this research is the online questionnaire, the data scale is too small, and the reliability of the data also needs to be considered. Further, this research focus on patient experience, the study of other stakeholders in the supply chain are not involved.

Upcoming research should apply field trips to collect data, in order to enhance the reliability of the data and expand data scale. The study about other stakeholders' experience should be carried out, in order to study the reproductive travel from a comprehensive perspective.

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APPENDIX

APPENDIX The questionnaire for Chinese patients who had took part in reproductive travel in Thailand (English version)

Dear participants

Hello! Thank you very much for participating in this survey。I am Yidan Zhang, a master student in school of logisticts and supply chain, Naresuan university, Thailand. I'm doing a thesis research titeled in Efficient Assisted Reproductive Care Supply Cain : A Case Study of Chinese IVF' Patient from China to Thailand. This survey aims to understand your experience, motives and challenges when going to Thailand for assisted reproductive tourism. This questionnaire is anonymous. The information obtained is only for research. We will keep your information confidential. Please feel free to answer according to your actual situation and thank you again for your participation.

Part I

Demographic profile

1.What is your gender ☐Male ☐ Female

2.How old are you? _____

3.What is your education level?

☐junior high school ☐High school/secondary school ☐College

☐Undergraduate ☐Master's degree ☐ PhD

4.What is your occupation?

☐Staff ☐Senior management ☐Civil servant

☐Entrepreneur ☐Student ☐ Freelance

5.What is your average monthly income(Yuan)?

☐ Within ten thousand ☐Ten thousand to Twenty thousand

☐ Twenty thousand to Thirty thousand ☐Over thirty thousand

Part II

Reproductive travel experience in Thailand

6.When suffer from infertility, how do you obtain reproductive travel information?

☐ TV/Newspaper ☐ Various websites ☐ recommendations from an acquaintance

☐ Recommended by people with similar experiences

☐ Consulting professional intermediaries ☐ Consult a nearby hospital

☐ Consult a large authoritative hospital

7.How many days will you arrange for the travel?

☐ Within 15 days ☐ 30 days ☐ 60 days ☐ more than 60 days

8.When going to Thailand for reproductive treatment, which way do you go abroad?

☐ Alone(Go to Question 10) ☐ With the group tour(Go to Question 10)

☐ Accompanied by relatives and friends(Go to Question 10)

☐ Find an intermediary company to arrange

9.When going to Thailand for reproductive treatment, what services does the intermediary company provide you (multiple choices)?

☐ Accommodation ☐ Ticket agent ☐ Visa agency

☐ Recommended experts ☐ Case organization ☐ Translation service

☐ Concierge service ☐ Doctor appointment Other _____

10.What type of assisted reproductive technology treatment did you receive in Thailand (multiple choices)?

☐ IVF own gametes ☐ IVF donor oocyte ☐ IVF donor sperm

☐ Intracytoplasmic sperm injection（ICSI）

☐ Preimplantation Genetic Screening (PGD) ☐ Surrogacy

☐ Fertility preservation Other _____

11.What is your motivations for travelling Thailand (multiple choices)?

☐ Long treatment waiting list in own country

☐ Treatment not permitted by law in own country

☐ Gamete shortage in own country

☐ Privacy—not wanting others to know about treatment

☐ Thailand has a higher success rate

☐ Treatment is cheaper in Thailand

☐ Sex or trait selection

☐ Good medical technology and services in Thailand

Other _____

Part III

The satisfaction of clinical care service of Chinese patient in Thailand

12.Thailand clinic adequately prepared you for treatment

☐Strongly agree ☐Agree ☐Neutral ☐ Disagree ☐Strongly disagree

13.The information prepared by the Thailand clinic is consistent you're your previous understanding

☐Strongly agree ☐Agree ☐Neutral ☐ Disagree ☐ Strongly disagree

14.Easy to obtain treatment in Thailand

☐ Strongly agree ☐Agree ☐Neutral ☐ Disagree ☐Strongly disagree

15.Thailand clinic had professional counseling services available during treatment

☐ Strongly agree ☐Agree ☐ Neutral ☐ Disagree ☐Strongly disagree

16.Thailand clinic satisfied your overall medical needs

☐ Strongly agree ☐Agree ☐Neutral ☐ Disagree ☐Strongly disagree

17.Thailand clinic satisfied your overall expectations for treatment

☐Strongly agree ☐Agree ☐Neutral ☐ Disagree ☐Strongly disagree

18.You would not hesitate to recommend this clinic to others

☐Strongly agree ☐Agree ☐Neutral ☐ Disagree ☐Strongly disagree

Part IV

Challenges faced by Chinese patients undergoing treatment in Thailand

19. What are the challenges and obstacles you encountered in the reproductive travel in Thailand (multiple choices)

☐ Difficult to obtain effective and reliable expert information

☐ Expert resources are low, waiting time for treatment is too long

☐ Expense is high

☐ Privacy is not protected

☐ High pressure and tight time

☐ Language

Other _____

赴泰国接受辅助生殖旅游治疗的中国患者

问卷调查（中文版）

尊敬的赴泰国接受辅助生殖旅游治疗的中国患者:

您好！非常感谢您参与本次问卷调查。我叫张一丹，是泰国纳黎宣大学物流与供应链学院的在读研究生。我正在进行我的论文研究，研究题目是：辅助生殖旅游高效供应链：以中国赴泰国接受试管婴儿治疗的患者为案例。本套问卷调查是为了了解您赴泰国接受辅助生殖旅游的经历，动机和挑战。本问卷采用匿名形式，所获取的信息只用于研究与论文写作，我们对您回答信息绝对保密。请您根据您的实际情况放心作答，再一次感谢您的参与。

第一部分

基本信息

1.您的性别 ☐男 ☐女

2.您的年龄 _____

3.您的文化程度 ☐初中 ☐高中/中专 ☐大专 ☐本科 ☐硕士 ☐博士

4.您的职业 ☐公司职员 ☐公务员 ☐企业家 ☐学生 ☐自由职业

5.您的平均月收入 ☐1 万元以内 ☐1 万-2 万元 ☐2 万-3 万元 ☐3 万元以上

第二部分

患者在泰国接受治疗的经历

6.出现孕育难题时，您一般通过什么途径获取跨境辅助生殖信息的

☐电视/报纸 ☐各类网站 ☐熟人介绍 ☐相似经历的人介绍 ☐咨询专业的中介机构 ☐咨询附近的医院 ☐咨询大型权威机构

7.您一般出境旅游治疗会安排几天时间

☐15 天以内 ☐30 天 ☐60 天 ☐60 天以上

8.赴泰国进行辅助生殖治疗时，您通过哪种方式出境

☐独自　☐跟团　☐ 亲戚朋友陪伴　☐找中介公司安排

9.赴泰国进行辅助生殖治疗时，中介公司为您提供了什么服务（可多选）

☐食宿安排　☐机票代理　☐签证代办　☐专家推荐

☐病例整理　☐翻译　☐接送服务　☐医生预约　其他_____

10.您在泰国接受了哪种类型的辅助生殖技术治疗（可多选）

☐采用自己配子的体外受精手术　☐采用捐赠者卵子的体外受精手术

☐采用捐赠者精子的体外受精手术　☐软泡浆内单精子注射（ICSI）

☐胚胎植入前遗传学检验 PGD/PDS　☐寻求代孕服务

☐维持生育（如：精子、卵子、胚胎冷冻）　其他 _____

11.您选择泰国作为辅助生殖旅游治疗目的地的动机是（可多选）

☐国内排队等待治疗的时间过长

☐所需的治疗目前国内法律不允许

☐国内配子（如精子、卵子）捐赠短缺

☐隐私性，不想让别人知道您在接受辅助生殖治疗

☐泰国治疗成功率比较高

☐泰国医疗费用比较便宜

☐对胎儿性别与数量有要求

☐泰国医疗技术服务质量高　其他 _____

第三部分

中国患者对泰国医疗服务的评价

12.在治疗过程中，泰国医院为您做了充分的治疗准备

☐非常同意　☐比较同意　☐一般　☐不太同意　☐完全不同意

13.泰国医院准备的资料信息与您前期了解的一致

☐非常同意　☐比较同意　☐一般　☐不太同意　☐完全不同意

14.在泰国医院，很容易获得辅助生殖治疗

☐非常同意　☐比较同意　☐一般　☐不太同意　☐完全不同意

15.在您的治疗阶段，泰国医院提供了专业的咨询服务

□非常同意 □比较同意 □一般 □不太同意 □完全不同意

16.泰国医院满足了您的总体的医疗需求

□非常同意 □比较同意 □一般 □不太同意 □完全不同意

17.泰国的辅助生殖治疗和服务满足了您的总体期望

□非常同意 □比较同意 □一般 □不太同意 □完全不同意

18.您会毫不犹豫地向其他人推荐您接受治疗的泰国医院

□非常同意 □比较同意 □一般 □不太同意 □完全不同意

第四部分

中国患者在泰国接受治疗过程中遇到的挑战

19.您在泰国求诊过程中遇到的挑战与障碍有哪些（可多选）

□难以得到有效可靠的专家信息

□专家资源少，排队等待治疗时间过长

□费用昂贵，经济压力大

□隐私得不到保护，抗拒就医

□精神压力大，时间紧张

□语言沟通

其他 _____