CHAPTER 2
BRIEF SUMMARY OF EARLIER WORK

2.1 Literature review for deriving a theoretical model

This chapter provides an overview of the premises that have motivated to explore underlying factors with healthcare adoption along its interrelated characteristics and related communication deficiencies. The literature survey primarily comprises a procedure for deriving a theoretical model and an analytical model to operationalise the theoretically-driven research propositions. The literature review introduces the research issue of identifying the local drug adoption situation in the light of the global drug adoption procedure. Analyzing the poor healthcare outcome of India, this literature review highlights the barriers of drug adoption and shows what are the key dimensions needed to improve the adoption of late-entrant prescription drugs. This chapter establishes the background of research objective for the present study. Finally, this chapter establishes an appropriate causal relationship that justifies the hypothesis tested in subsequent chapters. Following Philips and Pugh [91], and Perry [92], the taxonomy of literature review, in the given context, has been presented schematically in Figure 2.1.
Based on the literature review relating to the concepts and dimensions of information sources that influence new technology adoption, the communicational impact on decision-making for new prescription drug was explored.

2.1.1 Literature related to healthcare adoption

The literature survey suggests that in developed nations, adoption of ethical drugs is well structured as the established government agencies [46-48] act as the regulator of prescription drugs, unlike the emerging unstructured market in India, where doctors play the key role in prescription decisions for late-entrant drugs [10, 49, 71-72]. Research on late-entrants and publications on clinical trials is expected to boost positive
intention for medical practitioners. Research communication plays cardinal role in research and development (R&D) drug development that leads to adoption of drugs in regulatory formulary or compendium (pharmacopoeia) [28-34]. The relevant research work, represented chronologically in Figure 2.1, depicts that most (i.e., >90%) of the work in this area was conducted in last three decades.

![Figure 2.1: Chronological representation of research work in drug adoption](chart.png)

**Figure 2.1: Chronological representation of research work in drug adoption**

![Figure 2.2: Studies evolved on drug adoption over the last century](chart2.png)

**Figure 2.2: Studies evolved on drug adoption over the last century**

Sharp increase in studies in this area as shown in Figure 2.2 indicates that the search for developing a responsive healthcare chain for NCD management is on. The healthcare supply chain is facing problems, and quality prescription drugs at affordable prices may not be reaching the end consumer, i.e., the patients. This is a global concern for healthcare sector. The variation in adoption decision is largely informational and communication based as argued in the introduction section. Again, pharmaceutical
companies need better strategies to promote pharmaceutical products and increase their return on investment (ROI). The pharmaceutical industry spends in millions for development of new ethical drugs based on the innovation of formulation or drug delivery. According to Turoff, a regular and ongoing training in communication transactions, knowledge sharing and use of information technology, schedules and planning guidelines is critical for effective and efficient prescription decision responses [96].

2.1.2 Constructs related to adoption

Success of medical communication in healthcare is dependent on the sources of information, tapped by the medical practitioners and how the information is used while prescribing LEGPDs. Literature review can be categorized based on the application of qualitative and quantitative methodologies, to determine the constructs that emerge during the study of prescription intentions of doctors. In subsequent sections, the research problem integrates these constructs, derived from literature review, for exploring the causal relationship among them. The constructs emerging from the wisdom received, directs to identify elements for each constructs and develop measurement scale for evaluating drug adoption accordingly. This approach can minimize uncertainty in adoption of LEGPD in local system as opposed to global situation of drug adoption.

2.2 Conceptualizing prescription behaviour

2.2.1 Factors driving drug adoption in developed market

According to Kobjaiklang [54], six factors contributed to the change in prescription patterns that reflects distinctive traits of maturing market, as summarized below:

i. People are living longer and healthier lives
ii. Direct-to-consumer (DTC) advertising

iii. The gender effect

iv. The demographic group

v. The rising cost of prescription drugs

vi. The managed care (HMO—Health Medical Organization) role

i. With the average life expectancy reaching 70 years in developed nations [78], the patient’s role in decision-making has increased and their demand is strongly focused on quality treatment. The expectation of patient extended life span had transformed the outlook of drug producers, contributing indirectly towards positive healthcare outcome of a nation.

ii. The next important factor is Direct-to-Consumer (DTC) advertising, through various media. This approach influences healthcare decision-makers, who are in turn influenced by their patient’s increased ability for medication choices based on their past experiences [97]. Empowered by many forces, such as the access to higher education, multiple accessible information sources and greater personal wealth, consumers had a much greater say in their own medical treatment.

iii. Considering the fact that women are more health conscious and are more influential than men in deciding their own drug adoption, women remained better candidates for DTC marketing.

iv. The demographic groups have cultural dimension-based healthcare outcomes that enrich economic and social progress of a nation by adopting new drug prescriptions [98].

v. Consequent to the above four factors influencing ethical drug industry, the rising cost of new drug development determined their adoption by consumers.

vi. Finally, the managed care (HMO), acting as support to healthcare regulator, is accordingly controlling pricing and selecting prescription drugs to improve disease [99]. Even though physicians have the ultimate responsibility for prescriptions, both
form a professional and legal perspective, this managed care environment influenced the physicians’ prescription intentions.

The paternalism type of prescription decision was at the sole discretion of physicians [68–70] that gradually got transformed to shared decision-making type of physician/patient relationship [100–102]. According to Adams and Drake, shared decision-making is an interactive process in which clients and practitioners collaborate to make healthcare decisions [103]. It assumes that both the patients and practitioners, i.e., the prescribers have important information to contribute to the process [104], in tandem with Weick’s model of organizing health promotion using communication loop [105]. Gradually, the role of communication in medical decision received greater importance with shift in patient–doctor relationship due to easy availability and access to information channels providing knowledge on disease management. The practitioners have the information on various interventions, including potential benefits and drawbacks, while the consumers are the experts of their own values, treatment preferences and experience of side effects [104,106]. In the same vein, Elwyn and Edwards reported that consumer’s interest to remain as active or neutral or passive decision-making with practitioners will lead to a consensual decision [107], better known as shared decision-making, where both prescribers and consumers have important information to contribute towards the treatment decision process [107-109].

In case of a complex disease like cancer, instituting shared decision-making improved treatment goal [110–111], probably due to more client satisfaction [111-113], improved follow-through with treatment [114-115] and positive healthcare outcomes [116-118]. To manage NCD treatments on the disease type (hypertension/cancer) based on shared decision-making model for consensual adoption will depend on market type (mature/emerging) as well as environmental challenges from socio-economic conditions (higher or lower ranked nation in SPI indices).
2.2.2 Causes of variation in adopting late-entrants

Under the above backdrops, the variation in adoption decision can be attributed to both human factor [119] and knowledge that enhance an entity’s capability for effective action [120-121].

More precisely, knowledge can be defined as the whole set of insights, experiences and procedures that accurately guide the thought, behaviour and communications of the people [122].

This research is related to some important findings obtained from the available literature. Firstly, the sources of medical communication influence drug prescription decisions. Such communication is mostly related to interpersonal communication between colleague physicians and drug marketers’ promotional communication [123-124]. However, the studies have used an abstract concept of drug adoption framework that is hard to match with data. Secondly, drug adoption literature has focused on prescription intention of antihypertensive drugs and variations existing in their decision patterns [125]. However, these studies have not found the causality for significant variation in drug adoption intentions of practicing physicians. In the same vein, emerging economies, mostly having uncertain fragmented markets, give rise to a further challenge in forecasting drug adoption prescribing behaviour. Reasons for non-compliance are varied in reported literatures, and research has been gathered predominantly through quantitative methods.

Some drug adoption studies have found that the severity of a person’s symptoms is associated with non-compliance [126–131]. Hence, it is difficult to use any reported model to operationalise drug adoption, particularly for India where LEGPD adoption attributes are not fully explored, or the causal relationship remained weak or poorly established. Finally, uncertainty in prescribing behaviour is due to patients not being seen as possessing the right, or the ability to engage in self-determination. According to
Bentley, a patient’s right to refuse medication is often portrayed as illogical, contradictory and even unethical [132]. This gap in traditional procedures to measure drug adoption decisions is identified in literature and critically evaluated during literature surveys. Mancini, Hardiman and Lawson concluded that “The type of treatment was not as important as having the ability to evaluate a variety of alternatives and having the self-determination to choose the method viewed as most effective”[133].

2.2.3 Physicians’ influence in drug diffusion

Again, Christensen and others advocated that physician-related characteristics play a significant role in the adoption level of drugs, differing according to communities [20]. Different studies suggest the importance of various physician-related parameters during drug adoption, to cite a few:

- Peay identified that the early adopters of a drug were likely to be young or middle-aged physicians, rather than older ones [84].
- In another study, findings showed that cosmopolite physicians with strong interpersonal communication channels were drivers of drug adoption [12].
- However, Duetz reported that the physician’s gender difference was reported as to be unlikely in having a meaningful clinical or economic consequence in drug adoption [134].

These findings indicate that a true understanding can be developed by examining the physicians’ characteristics including the number of years in medical practice and attitudinal responses to the source of information.

2.2.4 Knowledge and memory-based adoption decision

The new drug adoption is directly influenced by the level of the acquired knowledge of physicians. According to Boerkamp and others, habitual decision-making takes place when a choice is made without considering alternatives [62]. Greving and Denig et al. used different categories of antihypertensive drugs like CCB (Calcium
Channel Blocker), ACE (Acetylcholine Esterase Inhibitors), ARB (Angiotensin Receptor Blocker), BB (Beta-Blockers), DIU (Diuretics) as medications for the therapy of hypertension management [48]. From these five alternative antihypertensive drug categories, the physician will select a medicine/s that meets expectations like:

(i) user-friendly dosage schedule
(ii) efficacy in reducing morbidity/mortality
(iii) efficacy in lowering blood pressure
(iv) efficacy in preventing end organ damage

Hence, inter-physician variation in adoption decisions can be found. Gupta and others [27] reported that hypertension in the majority of population can be managed by changing lifestyle. The study supports the argument that physicians’ choice of antihypertensive would be based on two factors:

a. information acquired by a learning process
b. physicians’ knowledge of perceived benefits

Webb and Sheeran [135] in their meta-analysis explored causal impacts on behaviour resulting in low adoption intention, as explained by Bandura’s Social Cognitive Theory (SCT), which was used in a health behaviour model [136]. Self-efficacy, the belief in one’s ability to perform the necessary actions successfully, is an important component of SCT. It influences a physician’s perceived behavioural control (Figure2.3).
Since Schwarzer, in his Health Action Process Approach model, proposed self-efficacy as a mediator between outcome expectancies and intentions [137], the perceived behavioural control is determined by the perceived presence or absence of resources and opportunities and the perceived ability of these to induce or hinder performance. It is interesting to note that the perceived drug benefit is either supporting or impeding physicians’ drug adoption performance as depicted in Figure 2.4.
It is interesting to explore as to why perceived drug benefit is hindering physicians’ intention to build drug adoption. Moreover, infrequent standardization of perceived benefits as a variable leads to poor reliability and validity of measurement [71–72]. However, according to Bhatnagar and Ghose, consumers critically evaluate risk benefit ratio [138], and therefore small risk or adverse experience with new product might be perceived to outweigh large benefits. Hence, doctors are very critical if side effects are observed with new product prescription and without patients’ active participation in decision-making, new drug adoption might not succeed to penetrate through a highly competitive pharmaceutical market. The relationship between perceived benefit (or perceived risk) and sources of communication influences drug adoption decisions of doctors [71-72].
2.3. Sources of information impacting adoption

The aforesaid discussions on comparing and contrasting models suggest that the type of medical information accessed by doctors determines adoption of late-entrant prescription drugs. In the light of the literature findings, physician characteristics control the prescription intention that depends on practical experience with new drugs and their subject knowledge. However, this internal factor is also complemented with external factors that drive drug adoption. The diverse sources of medical information accessed during medical decision-making need to be studied to understand the external dimensions that determine drug adoption. The next section evaluates such information transaction effects for supporting adoption decisions.

2.3.1 Influence of commercial medical information

Prosser and others [66-67] recommends that medical communication plays an important role in drug prescription due to the interplay of attitude and information seeking behaviour. The communication skill of firm’s representatives (i.e., detailmen) is of utmost importance for drug acceptance by physicians [139]. According to Molloy and Strang et al. better quality of detailing has a positive impact on higher drug adoption levels [140]. A few pioneers of marketing research advocate that the higher the organizational drive is to lower product costs, the greater the perceived benefit and hence the greater the degree of adoption would be [125]. Literature data is inconclusive to demonstrate the causal relationship between information communications and intention to prescribe a branded drug (antihypertensive) in developing nations. One possible reason could be the paucity of empirical work or a lack of suitably detailed data, or there might be some other constraints.

2.3.2 Information sharing through trainings

According to Peay and others, the majority of doctors are ‘professional orients’ or ‘commercial oriented’ in their information source preferences [84-85]. Some researchers concluded that Dutch physicians preferred medical communication by
company representatives over professional sources like seminars or updated national guidelines [48]. On the contrary, French physicians preferred primary information sources like consultation with leading prescription practice guidelines, regular reading of medical journals and accessing electronic resources rather than simply relying on detailmen i.e. firm representatives as an information source [141]. It is evident from contemporary studies in developed nations that commercial and professional sources of medical information for drug adoption need to be integrated.

2.3.3 Word-of-mouth communication influences

Preliminary research outlines that socially integrated physicians’ and their colleagues introduce newer drugs in their practice more often than isolated physicians and their colleagues. This can be related to interpersonal communication facilitating the process of drug diffusion [129]. Physicians rely on their colleagues’ communication more than any company representative [62,97]. There was clear effect of referrals to an internist or cardiologist on ARB drug treatment, and most physicians indicated that they usually continued prescriptions initiated by a hospital physician [48]. Therefore, perception for ARB drugs as effective medication in lowering blood pressure promotes ARB drug adoption rates. Therefore, the influence of treatment opinion can be deemed as a driver of drug adoption. This needs to be revalidated in the Indian market.

Previous research has identified some social factors like word-of-mouth communication, social interactions through meetings and workshop participation that seems to act as a springboard for new drug adoption [97, 99, 142-144]. Following Weick’s concepts of social psychology [145], Mahajan and Peterson have conceived multi-product growth models, under the assumption of simultaneous launches [146].

They classify coexisting products in the marketplace into four categories: independent, complementary, contingent and substitute. Only substitute products generate competition. This is modelled through the introduction of within-brand and cross-brand word-of-mouth effects related to brand-specific residual markets [147]. Physicians may adopt a drug more than once and each prescription thus dispensed may
be classified either as an innovative action [12, 16, 148-150] or an imitative action (avoiding classification of agents) [17-19] as indicated by word-of-mouth communication involving physicians and patients develops drug adoption intention [48, 71-72, 151-152]. From an understanding of such relationships, project managers could steer pharmaceutical firms to fix production choices for antihypertensive drugs.

2.4 Theoretical linkage for operational definition

Considering the uptake of pharmaceutical innovation in healthcare system [143], the below-mentioned sections address the construct of attitudes (Section 2.4.1), the relationship between attitudes and beliefs (Section 2.4.2) for multidimensional drug adoption scale development (Section 2.4.3). Next, revealing the relationship between attitudes and behaviours (Section 2.4.4) impacting adoption, followed by integration of qualitative literature synthesis leads to identification of literature gap that allows the study to conclude this chapter with a summary (Section 3.2.5).

In past two decades, several theoretical models have been proposed to assess and explain end users’ acceptance behaviour towards information and communication technology (ICT for short) [144, 147-148, 150-151, 153]. The Technology Acceptance Model (TAM), which is applied and empirically tested over a wide spectrum of applications of ICT, is one of the well-recognized theoretical modes among them [154-155]. Recent studies provide evidence that TAM is a good predictor of behavioural intent to accept technology in the health sector [156-157].

In TAM, technology acceptance and use is determined by Behavioural Intention (BI). BI, in turn, is affected by attitude towards use (ATT), as well as the direct and indirect effects of perceived ease of use (PEoU) and perceived usefulness (PU). Both PEoU and PU jointly affect ATT, while PEoU has a direct impact on PU [156-157]. The TAM model is an analytical simplification of how functionality and interface characteristics relate to adoption decisions, understanding why clinicians hold certain
beliefs about adoption. Although TAM is considered as a well-recognized model in the field of information systems, little systematic research has been conducted in the healthcare context, indicating a significant gap in knowledge. Therefore, currently, there is a strong need to develop and gain empirical support for TAM within health organizations; more replication studies are needed so that confidence is gained in whether TAM is a good fitting theory in healthcare. This may be achieved by using larger size samples, by investigating and exploring new theoretically motivated variables and relationships, by testing external variables, as well as by applying TAM on different profession-specific groups of personnel (e.g., different physician specialties), etc.

Some authors, while employing TAM in healthcare adoptions, highlight several inconsistencies in previous reported methods as enumerated below [156-159]:

i. poor sample size
ii. convenience research methodology, i.e., absence of justified research design, impacting data collection method
iii. lack of intervening relationships among the TAM constructs, as moderator and mediator relationship are not adapted in model
iv. technology usage has been generic and has not been customized into healthcare concepts
v. relationships among TAM variables have not been grounded as per the proposed healthcare inquiry

This literature gap provides the background for designing a contextual research process [71-72]. Based on the comparing and contrasting literature, the key constructs are defined for the proposed drug adoption model in Table 2.1
Table 2.1: Summary of key constructs

<table>
<thead>
<tr>
<th>Theory</th>
<th>Construct</th>
<th>Definition of Construct</th>
<th>Leading Literatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Adoption Model (TAM)</td>
<td>Perceived usefulness</td>
<td>Perception that using system leads to enhanced personal performance, i.e., more information communication for decision-making</td>
<td>[11-12,155-160]</td>
</tr>
<tr>
<td>Theory of Planned Behaviour (TPB)</td>
<td>Perceived Behavioural Control</td>
<td>Perception of internal and external resource constraints on performing behaviour (adaption of TPB)</td>
<td>[155-158,161]</td>
</tr>
<tr>
<td>Unified Theory of Acceptance and Use of Technology (UTAUT), TAM and TPB</td>
<td>Social influence/Word-of-mouth communication</td>
<td>Perception of important (or relevant) other’s belief about person’s use of system</td>
<td>[55,142,153,155,157,161-162]</td>
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2.4.1. Communication factors for drug adoption

With an objective of achieving customer responsiveness, integrated marketing communication plays an important role in building and maintaining stakeholder relationships and in leveraging these relationships in terms of brand and channel equity [163-165]. As the existence of a database, calibrated to measure customer and stakeholder responsiveness of campaigns, can facilitate measurement of performance, such measurement unit can be linked to drug adoption by doctors in response to integrated marketing communication.

In this section, the key theoretical constructs are defined to explain communication diffusion among stakeholders in the medical community, considering
those utilizing the services and facilities of common medical centres [157,166-167]. The key communication drivers consist of firms’ marketing techniques and facilitating conditions [168-170]. The available literature indicates that supply chain management practices go beyond purchasing and logistics activities [171-172] and hence, this research integrates communication dimensions into Healthcare Communication model as discussed in the ‘Introduction’ section of this dissertation. The study should be highly beneficial in the unstructured pharmaceutical market, characterized by institutional, political and cultural barriers, where some part of demand for the new branded drug remains unfulfilled due to a lack of effective communication strategies [168-171].

2.4.2 Perceived usefulness in drug adoption

Firms that create perceived usefulness for their new product technology elaborate that such ‘usefulness’ referred to either incremental performance (i.e., with fewer steps in decision-making) or enhanced outcome (i.e., more efficient care and more appropriate decisions) [12,125,142,150,155]. Perceived usefulness is considered in the current research as a performance-enhancing dimension that leads to more efficient decision-making by the doctors due to effective communication [156-158]. In the healthcare supply chain, a firm’s sales representatives frequently meet the practising doctors to communicate and persuade the usefulness of their brand [80,172] compared to other brands, including pioneering branded drugs. Doctors perceive that their behaviour is influenced by the drug companies as the firms’ sales representatives use diverse communication technologies in printed, visual or audio form as promotional strategies for their brand positioning [14,173-174]. The aim is to provide doctors with medical information necessary for a patient-centred practice [68-70]. Since patients are seen as indirect strategic purchasers who have a choice as to which healthcare provider they choose, doctors’ communication skills become highly important [45,69,72].

To sum up, researchers suggest that the perceived intention, i.e., customised to PBI of early-adopter doctors, is influenced by the pioneering advantage, e.g.,
technology-based ease of use, unlike the late-adopter doctors who mainly consider perceived usefulness [13-14,84].

2.4.3 Social influence of communication on drug adoption

A substantial body of research indicates that interpersonal communication has a significant impact on consumer purchasing behaviour. These studies look into the determinants of drug adoption, using ‘imitation theory’ or ‘consumption externality theory’ [16,98-99,149]. Both concepts rest on premise of social influence within the same or allied groups of practitioners, which affect each other’s drug-prescribing intentions for new brands [175]. Prescription by a senior doctor or consultant is followed by junior, less experienced doctors, due to imitation effects [72–73]. The diffusion literature suggests that both these effects are due to the social influence from the doctors’ community and are largely information related in nature [70,71,158,159]. Researchers report social influences, based on interpersonal communication [160–163] between doctors, involve networking skills and the peer effect relationship, which are not limited to interactions at the institutional level. Following Webster’s strategy of field sales management [181], the firm–institution collaborative training programmes can provide a platform for doctor interaction, which affects intentions to adopt, also leading to word-of-mouth communication [182]. Social influence has been operationalised by information through word-of-mouth communication, influencing medical decisions in hospitals [183-184]. Word-of-mouth communication is considered to be independent of commercial, direct marketing influences [158], in relation to sharing information between consumers about a product or service [159,163-164,185]. When there is perceived risk and uncertainty grips in supply chain [165], consumers rely on WOM communication which is often associated with service purchase decisions [158].

However, WOM communication can have both positive and negative effect in determining the level of drug adoption [146]. In the context of late-entrant drug–purchase decisions, unless performance reliability [125,159] is established, weak word-
of-mouth communication will lower drug adoption [186]. More precisely, social influence, usually operationalised as word-of-mouth (WOM) communication among doctors, remains low or even shows negative relationship, when side effects of prescribed new brand become evident [87-88].

According to Ramsaran–Fowder, this situation leads dissatisfied doctors to switch to other alternate brands in the market [56]. Following Grewal, pioneering brands are better remembered for their advantages [152], and the late-entrant would be remembered more for emergence of any undesired/side effect. Such negative WOM communication is due to the prevailing market conditions that implies a varying degree of adoption uncertainty [187]. However, it is unclear whether direct marketing communication from pharmaceutical firms to doctors or indirect WOM communication within the doctors[98,188], or both simultaneously, influence the adoption of late-entrant branded antihypertensive drugs.

2.5 Linking communication with healthcare outcome

Communication is the exchange of ideas, thoughts, information and feelings in which human beings engage effectively only when the messages are received and decoded correctly and the transfer of meaning is not impeded by any kind of barriers. However, there have been very few studies that examine the influence of medical information communication on drug adoption and the understanding of the mechanism, through which doctors exert this influence while treating both hypertension and cancer diseases, is limited.

The subsequent subsections show as to how perception oscillates while treating a simple to complex set of challenging diseases. In order to adapt to health risks impacting health behaviours and health outcomes, health information is the critical resource derived from effective health communication [105,170]. According to Kreps, the positive influences of increased patient communicative involvement in treatment leads to desired health outcomes [190-192]. To achieve higher adoption of quality-
driven prescription drugs, studying communication models becomes essential. Historically, interpersonal communication theories, stemming from Communication Accommodation Theory (CAT) and Speech Code Theory (SCT) support the underlying assumption that interpersonal communication is transactional where stakeholders simultaneously affect each other to influence decision-making [178-179]. More recent research has paid greater attention to provider–patient relationship exploration, by applying Social Penetration Theory (SPT) and the norm of reciprocity and Communication Privacy Management (CPM) [180].

2.5.1 Communication for hypertension management

Researchers have explored the prescribing behaviour for innovation drugs and rate of drug adoption. Paucity of studies in the late-entrant branded drugs for chronic disease like hypertension fails to penetrate the market against pioneering brands. Despite the availability of affordable efficacious and safe medicine (antihypertensive drugs) due to rampant growth of indigenous pharmaceutical industry, hypertension patients and related mortality are increasing day by day. According to Bloom and Gupta, the overall prevalence of hypertension in India has been the highest among other NCDs [15,75]. Drug adoption using the example of Angiotensin Receptor Blocker (ARB), a very promising and safe antihypertensive drug, has been studied to shed light on improving the treatment efficiencies [28,48,51-52,78].

However, very limited research has anchored the impact communication concepts in measuring drug adoption for treating hypertension disease in emerging market like India.

Though research on antihypertensive drug launches in developed countries has been conducted [48,78], the extrapolation to developing nations will not be appropriate due to the significant disparity in economic and social factors. Despite the need to examine the applicability of two different theories, imitation effect [16,149,193] and cultural effect [194-195], research on emerging markets is scant in comparison to drug adoption decision management in structured markets of developed nations [51,66].
Therefore, what determines the success for international firms and why there is a high degree of variation in the acceptance of alternative branded drugs are the questions echoed after studying the existing body of knowledge [49,87]. Elucidating the pattern of drug adoption for a complex disease like cancer enriches the knowledge on factors impacting late-entrant drug adoption [33,87].

2.5.2 Communication for cancer management

Kreps defines cancer communication research as the study and application of the process of exchanging and interpreting strategically designed messages, delivered interpersonally and through selected media that convey relevant health information to targeted audiences like healthcare consumers, cancer survivors, healthcare providers, researchers, patients, at-risk populations, etc.[189-192]. According to Viswanath and Finnegan, effective use of communication across the continuum of cancer care is often very complex and challenging [196]. Therefore, researchers argue that there is a demand for strategic and persuasive communication to influence health behaviour particularly at prevention, detection, diagnosis, treatment, survivorship, and end-of-life care stages of cancer treatment [197-198]. In the similar vein, Lackey and Gates also reported that cancer diagnosis, uncomfortable cancer-screening techniques and procedures demand effective interpersonal communication [199-200]. According to Rowland et al. there is a demand for both sensitive and informative communication to promote psycho-social adjustment and adaptation for cancer survivors [201]. Furthermore, to meet these demands of psychological and socio-emotional support, surrounding different individuals’ experiences, relational communication needs to be supplied with up-to-date information [202]. This type of communication about the key issues of patients’ concern supports the best health-related prescribing decisions and adopting health-preserving behaviours [203].

Literature suggests that persuasive informative education for cancer treatment communication as well as behavioural intervention programmes are important preventive measures against cancer treatment [204,205]. Since, there is a great deal of
uncertainty regarding how to approach the cancer treatment tasks, communication among stakeholders within the society would have addressed the research gap. The social influence in the form of positive word-of-mouth (WOM) communication intensifies physician–physician interaction [97,206] supporting consumer satisfaction, i.e., adoption [167,207] while with conflicting word-of-mouth communication, Gheorghe and Liao, rejection or brand switches are the natural outcome [208]. Employing attitude modelling of Ajzen [161] to analyze consumer/adoptee’s characteristics, Ronteltap and others’ [125] communication diffusion of treatment interventions can meet the demand of healthcare services for cancer and hypertension treatments.

Surveyed literature indicates that the communication enables consumers and healthcare providers to gather relevant health information.

2.6. Changing perspective in prescribing new drugs

2.6.1 Evolution of drug adoption

Over the years, prescription decision-making process has improved with the development of medical science and information technology. So, broadening the predicting horizons is necessary in order to take drug prescribing model beyond its present boundaries.

The roots of western medicine lie in ancient Egypt about 5000 years ago. The earliest known physician, Imhotep, lived around 2600 BC, and he has been responsible for preparing and dispensing medicines, playing multiple roles of the then ancient societies [209]. Imhotep was an outstanding man since he was not only a great physician but also a poet, a priest, a judge, prime minister (visiting) of the Pharaoh Zoser and even the architect who designed the pyramid of Saqqara. Egyptian doctors described what is currently known as ‘medical semiology’, since to them an organized physical examination was central for medical work [209-210]. They used to conduct
“medical manoeuvres” (such as inspection, palpation and auscultation) in order to obtain information from the patient’s body. Although they did not conceive the concepts of disease, as we currently know them, they used the concept of syndromes, i.e., a group of signs and symptoms that delineate a recognizable pattern [210-211]. The same prescribing model, used in Indian ancient medical practices, is rooted back to 2500 years.

In India, the medical decision management in surgery as prescribed by Sage (Maharshi, in local terms) Sushruta, endowed with the title ‘Father of Surgery’, has been reflected in medical compendium Sushruta Samhita. He had described around eight special operations for surgery, such as the cutting, piercing, opening, scratching, inserting, and stitching. Sage Shushruta was a practitioner and a teacher of surgery. His contribution towards the Indian traditional medicine and the ancient cultural heritage of India will always be considered precious. He became very famous for his writings and these were first translated into Arabic language (as a Kitab-i-Susrud in the 8th century CE) and consequently into Latin and English languages. Maharishi Shushruta had become a worldwide legend and was famous in many areas like doing surgery of the eye, amputations of the limbs and handling various complications after childbirth. His Sushruta Samhita is the key reference book for all the Ayurvedic surgeons/practitioners [209].

The drug prescription and treatment procedures discovered by Sushruta in 600 BC have also received a special mention in surgical practice in London (1793) and has been held at high esteem by Great Moments in Medicine, a Parke-Davis promoted medical historical book edited by G.A. Bender in 1966 [209]. The historical review allows researchers to understand paradigm shift in medical decision-making with the dynamics in the practitioner’s cognition. The historical background (Egyptian, Mesopotamian, and Indian) suggests that practitioners, like Imhotep, play multiple roles as social actors. This practice of being in touch with many disciplines provided them with an opportunity to get ideas or concepts outside the medical field, which enriched their medical knowledge [210]. The blend of knowledge from diverse fields is a very
useful in giving the researchers new concepts and ideas which may lead us to solutions to yet unsolved matters in the medical field [211]. Sushruta’s pioneering prescription pattern connotes that profound volume of medical information had been processed to discharge quality healthcare, probably due to lesser number of intervening stakeholders in the healthcare value chain. Even today, the ancient Indian medical decision-making and practices are held in high esteem globally, though modern India even in the age of digitalization and e-commerce remains the prisoner of indecision in practicing shared decision-making in accomplishing treatment success.

2.6.2 Transformation of local drug adoption

The historical concept of healthcare delivery has transformed with the nation’s exposure to information technology and changing perception of drug adoption linked to healthcare innovation, over the last four decades. An emerging economy like India faced the challenges of market dynamics with costly innovator drugs sold to Indian consumers [212] that had resulted in uncontrolled rise of mortality rates.

The innovator companies marketed their products well before the eighties but as domestic producers manufactured cheaper generic-drugs, adoption of drugs increased to meet the demand [37-39,212]. In the 1990s, the conditions improved as Indian firms were the producers-cum-marketers for their consumers [43,50,213-214]. At this time, the investments in R&D boosted quality of drugs supplied to consumers.

However, in the past decade, with rising R&D costs and governmental price-cap on essential commodities, a very fragmented pharmaceutical market evolved with the growth of domestic small and large scale firms [214-215]. Though the healthcare outcome improved with reduction in mortality rate in India, presently, the variations in prescription decision for quality drug adoption remains uncontrolled [4,6]. Moreover, fund allocation of 4.8 per cent of total government expenditure on healthcare (in 2012), in comparison to 14.4 per cent across OECD countries in 2012, had caused sharp rise of out-of-pocket costs (reaching almost 60%) towards healthcare [40-41].
Poor expenditure on healthcare indicates impeding barrier on a country’s social progress and thus needs to be evaluated before exploring the relationship with all its dimensions. Total health expenditure is the sum of public and private health expenditure that includes the provision of health services (preventive and curative), family planning activities, nutrition activities and emergency aid designated for health (excluding provision of water and sanitation). As healthcare expenditure calculated as percentage of GDP was 3.87 in 2011 (World Bank), the current picture of India in comparison to rest of the world [41] is not impressive. It probably indicates the poor performance on SPI score (102nd rank), as depicted in Figure 2.5.

![Figure 2.5: Nations’ healthcare expenditure linked with SPI rank](image)

The economic survey data reveals that Indian social service sector, particularly healthcare has been neglected in budget allocations [40]. Moreover, healthcare expenditure, as percentage of GDP has decreased from 1.4% (in 2009–2010) to 1.2% (in 2014–2015) and if domestic investment activity does not pick up the stream, achieving social progress will be highly challenging [40–41]. Other factors will play a
crucial role in making healthcare programme better as the current programme is not conducive to social growth. The scope of higher drug adoption to achieve quality treatment has, therefore, been exclusively investigated under the prevailing uncertainty of generic drug adoption.

2.6.3 Communication gap in local healthcare supply chain

Communication gap in medical supply chain inflicts uncertainty in drug adoption. Since there is marked uncertainty in drug adoption in SARRC countries, preparedness to face the uncertainty for the nation is very essential [216-217]. Researchers assume that under environmental uncertainty, the positive intention of the decision-makers might be intercepted by their limited information processing and communication ability, even though they might be acting rationally [217]. Further, in the presence of environmental uncertainty [218], performance cannot be easily verified due to underlying behavioural uncertainties. Again, researchers argue that behavioural uncertainty is due to inability to predict partners’ performance on key variables like price, delivery and adaptability. Since, environmental uncertainty denotes market uncertainty, arising due to demand uncertainty and competition uncertainty [219], specific information sharing asymmetry conditions surround the key stakeholders of a medical supply chain needs to be explored. Collectively, the coordination of information exchange is critical for implementation of partnership, indicating the need of increased information sharing among stakeholders/channel partners of supply chain [192]. Lack of communication supply for integrating information exchange in the fragmented market can lead to uncertainty in prescribing behaviour.

Consequently, the lack of clarity for new drug adoption in India due to uncertain on clinical viability/efficacy and financial affordability of consumers have contributed to late-entrant’s becoming less economically attractive, socially questionable and politically unappealing. Therefore, in the current context, drug producers’ exposure to environmental uncertainty needs to be restricted by firms’ aligning medical information,
communicated through the channel member, that seems to contribute towards doctor’s decision uncertainty. Again, market uncertainty entails volatility in demand, buyer preferences, and competition [219], thereby increasing the difficulties of doing business in the Indian market. Since, coordination provides flexibility for pharmaceutical firms to cope with the uncertainty information sharing, a major mode of coordination [220], should be effective to build healthy partnership among stakeholders. The same concept can be applied in triad partnership where firms are the ethical drug-suppliers, physicians and their counterpart consumers (i.e., patients) participate in information sharing to have an effective treatment goal.

Therefore, based on environmental uncertainty concepts, information sharing [221] in medical supply chain seems to inflict behavioural uncertainty among drug adopters, practicing within close network. Such uncertainty in late-entrant prescription drug adoption is indicative of poor performance in India’s healthcare outcome. Market uncertainty can be minimized with healthcare innovations supported with clinical trial communication [222] that gets supported by regulatory adoption. This ultimately reduces market uncertainty and behavioural uncertainty that resides in late-entrant branded drug adoption that increases with increase in disease complexity [87].

2.6.4 Local firms’ perspective on prescribers’ decision

Following Gorini, the decision-making process for prescribing a particular class of drug, having unique mechanisms of action, is a complex phenomenon as it varies as per patients’ own immune systems [223]. In an increasingly competitive marketplace, pharmaceutical companies offering generic drug products to the medical practitioners are continually looking for ways to gain a competitive edge. Similarly, practitioners in the healthcare industry, seeking to prescribe products or services are continuously looking for ways to make good purchasing decisions. Therefore, the amount of information required to make a purchase becomes important.

Availing detailed factual information supports making a rational decision while exposure to insufficient information or deficient consideration set, leads to a flawed
acquisition decision [224]. Problems can arise from having too many or too few people involved in the supply chain as decision-making process becomes inaccurate. Further, specific needs of affected groups may be overlooked if not enough people are involved in the decision-making process [224-227]. Therefore, understanding how drug purchasing decisions are made through prescriptions and factors that most significantly influence them, are highly essential for successful purchasing outcomes along with competitive advantages. Following Schwartz’s paradox of choice [228], decision-making becomes more challenging due to wide variety of competitive brands having different mechanisms and actions to reduce a particular disease.

The available products in pharmaceutical markets can generally be divided according to three characteristics: the illness they are designed to treat (therapeutic market), their active ingredient (molecule), and their producer (brand)[229]. While molecules differ in their effectiveness, side effects, dosage form and other attributes, brands may differ in price, packaging and dosage frequency [80]. Since consumer uncertainty is likely to be most important in the former dimension as pointed out by Hellström [216], the study primarily focuses on inter-molecular choice in the antihypertensive market.

Most drugs differ both in their effectiveness and their incidence of side effects across patients, uncertainty is an important and long-recognized component of drug choice [230-231]. Furthermore, the demand for prescription drugs has been derived from the demand for restoring health condition. The drugs are used as inputs in a treatment process for a particular illness, the goal of which is to eliminate the need for further treatment. As costly treatment continues in the form of repeated prescription until symptoms abate [231], there is strong motivation to experiment if a given treatment is ineffective to beat the consumer satisfaction [232]. The literature indicates that post-patent entry of generic medicines, ‘particularly the first to file product’ as discussed by Hollis [233] is affected by the market characteristics, behaviour of innovator companies and the existence of incentive structures that promote generic development and production by the generic industry.
Under the above backdrops, the market entry of generic medicines following patent expiration is highly dependent on factors that are either internal or external to a potential generic drug entrant. Generally, in the generic drug market, the ‘earlier entrants’ (or ‘incumbent generics’) assume a pioneering advantage (early mover advantage) in the market [171] and tend to have a sustained market share which may create a disincentive for subsequent entrants [179–180]. This situation arises because consumers and providers are unwilling to incur switching cost for switching to the ‘late entrants’. However, the results of clinical trials to establish LEGPD performance if communicated to prescribers properly then the level of drug adoption can increase. More precisely research communication related to product differentiation can be the key to success to act as breakeven point for achieving marketing success [234].

In order to have insight on previous researches, a communication model is imperative to investigate the factors influencing prescription [235-238]. The extant literature is lacking in that the investigations on factors driving prescription of late-entrant drug products in uncertain or emerging markets are either very limited or not published yet. The pharmaceutical business is all about prescriptions, without prescriptions written by physicians there is no business and without patients there are no customers for pharmaceutical products. In sum, the pharmaceutical industry concentrates its effort on marketing strategies dedicated towards persuasion of physicians’ decisions [236,238]. Even if marketers are able to predict and give direction accurately, they would be hard pressed to really know which sources of information [236] and their marketing mix (i.e., sales campaign, journal advertising, opinion leaders, direct mail, educational etc.) were directly contributing and by how much, and which aspects of their current sales were, in fact, contributing to impact in market share.
2.7 Techniques for healthcare adoption measures

2.7.1 Knowledge mining on healthcare adoption

Knowledge discovery in databases is a well-defined process consisting of several distinct steps [238-239].

Knowledge mining with the help of a skilled employee, who has good understanding of healthcare industry, can be effective at working with a large volume of data to determine meaningful patterns and to develop strategic solutions [239-241].

Data mining is the core step, which results in the discovery of hidden but useful knowledge from massive databases [242]. A formal definition of knowledge discovery in databases is given as follows: ‘Data mining is the non-trivial extraction of implicit, previously unknown and potentially useful information about data’ [243]. Data mining technology provides a user-oriented approach to novel and hidden patterns in the data [244]. The discovered knowledge can be used by the healthcare administrators to improve the quality of service as well as by the medical practitioners to reduce the number of adverse drug effects, to suggest less expensive therapeutically equivalent alternatives [244-245]. Following are some of the important areas of interests where data mining techniques can be of tremendous use in healthcare management:

i. Data modelling for healthcare applications
ii. Executive Information System for healthcare
iii. Forecasting treatment costs and demand of resources
iv. Anticipating patient’s future behaviour given their history
v. Public Health Informatics
vi. E-governance structures in healthcare
vii. Health Insurance

Traditionally, decision-making in healthcare has been based on the ground information, lessons learnt in the past resources and funds constraints. However, data mining techniques and knowledge management technology can be applied to create knowledge rich healthcare environment [245]. Healthcare analyst and policy-makers can
learn lessons from the use of knowledge mining in other industries and apply knowledge mining technologies to problems of healthcare industry (hospitals, insurance companies, pharmaceutical companies, physicians, etc.). Healthcare data is massive. It includes patient-centric data, resource management data and transformed data [246]. Healthcare organizations must have the ability to analyze data. Treatment records of millions of patients can be stored and computerized and data mining techniques may help in answering several important and critical questions related to healthcare [246]. Following are the few examples of such questions:

i. Should the course of treatment for a cancer patient include chemotherapy alone or chemotherapy plus radiation or radiation alone?

ii. What can a doctor do to improve his efficiency for treating a hypertensive patient?

iii. Can human patient databases be sampled up against diseases to develop prescribing intention models?

iv. Can weak prescribing intention be checked?

However there can be a concern of patient privacy. It is more than clear that the role of data mining is not to practice medicine but to improve useful information and knowledge so that better treatment and healthcare can be provided [87,88]. Massive healthcare data needs to be converted into information and knowledge, which can help control, cost and maintain high quality of patient care. Physicians with more information sources and beliefs that were congruent with the recommendations were more likely to move towards adherence. This research suggests that small group sessions and social interaction during the middle phases were central to the adoption of new medical treatments. There is a growing awareness of suboptimal physicians’ decisions but to cognitive failures occurring during the clinical decision-making process. Despite cognitive limitations and uncertainty individuals must continuously take decisions. Such suboptimal decisions can sometimes lead to adverse consequences for the patient.
Therefore, better patient care and health outcomes can be accomplished by an improved decision-making process on the side of the physician. To understand the pattern of adoption decision, a qualitative research is required to be conducted both for a simple disease like hypertension and a complex disease like cancer. Qualitative research is devoted to developing an understanding of human systems, be it small, such as a technology-using teacher and his or her students and classroom, or large, such as a cultural system. Qualitative research studies typically include ethnographies, case studies and generally descriptive studies [247]. They often are called ethnographies, but these are somewhat more specific. For instance Goetz and LeCompte, define ethnographies as ‘analytic descriptions or reconstructions of intact cultural scenes and groups’ [247]. A case study may indeed be viewed as ethnography; however, the investigator may set out to answer a particular question rather than to describe a group or scene as a whole. Qualitative research methods typically include interviews and observations but may also include case studies, surveys and historical and document analyses [247].

2.7.2 Data mining applications in healthcare industry

Knowledge mining is used in business domains to provide insights on large data [248]. Data mining in contrast to traditional data analysis is discovery driven. Data mining is a young interdisciplinary field closely connected to data warehousing, statistics, machine learning, neural networks and inductive logic programming [249-254]. Data mining provides automatic pattern recognition and attempts to uncover patterns in data that are difficult to detect with traditional statistical methods. Without data mining, it is difficult to realize the full potential of data collected within healthcare organization as data under analysis is massive, highly dimensional, distributed and uncertain. Healthcare institutions maintain a repository of patient data.

These data show patient characteristics, disease and symptoms. Business intelligence applied to such data can elucidate patterns of prescribing intentions if patients’ characteristic is influencing medical decision. To enable the study to have meaningful insights into the huge amount of patient data retained in a hospital
repository, data mining techniques, as summarized in Table 2.2, are applied to model large amounts of data summarizing it into useful information or knowledge [248-250]. Nowadays, a large amount of medical data/patient history is collected by healthcare organizations that lack an intelligent tool [244] for developing a decision models based on this data for their physicians. Table 2.2 shows the recent resurgence of data mining application on healthcare issues (that has been reproduced with permission as referred in Appendix AX2, page 239).

Table 2.2: Data Mining (DM) application in healthcare industry

<table>
<thead>
<tr>
<th>References</th>
<th>Knowledge Resources</th>
<th>Knowledge Types</th>
<th>DM Tasks</th>
<th>DM Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaur et al. [251]</td>
<td>Healthcare-Empirical paper</td>
<td>Healthcare industry</td>
<td>Decision Tree; Artificial Neural Network</td>
<td>Drug Development, (Diabetes)</td>
</tr>
<tr>
<td>Lavrac et al. [244]</td>
<td>Healthcare-Research paper</td>
<td>Health-care providers database; The out-patient database and medical status database</td>
<td>Classification; Clustering</td>
<td>Clustering Methods: Agglomerative; Classification;</td>
</tr>
<tr>
<td>Hwang et al. [248]</td>
<td>Healthcare-Research paper</td>
<td>Knowledge Measurement Conversion and Transfer</td>
<td>Knowledge Dependency Modelling</td>
<td>Sequential pattern Analysis</td>
</tr>
<tr>
<td>Ranjan [252]</td>
<td>Healthcare-Conceptual paper</td>
<td>Pharmaceutical industry</td>
<td>Disease Management; Clustering</td>
<td>Drug Development, Discovery, Clinical trials</td>
</tr>
<tr>
<td>Khaleelet al. [253]</td>
<td>Healthcare-Research paper</td>
<td>Diabetic treatment; predicting mode in different age groups</td>
<td>CART</td>
<td>Cardiovascular and cancer treatment therapy</td>
</tr>
<tr>
<td>Milovicet al. [254]</td>
<td>Healthcare-Research paper</td>
<td>Hospital Information system; Patient record and pattern evaluation</td>
<td>Disease management; prediction in disease</td>
<td>Decision Tree, Genetic Algorithm, Artificial neural Network</td>
</tr>
</tbody>
</table>
All the above reported works suggest that without data mining, it is difficult to realize the full potential of data collected within healthcare organization as data under analysis is massive, highly dimensional, distributed and uncertain.

### 2.7.3 Qualitative inquiry on healthcare adoption

Guba’s and Lincoln’s ‘fourth generation’ of evaluation overcomes most of the problems of traditional forms of evaluations inspired by positivist traditions [255]. Guba and Lincoln reject the position that the use of proper methods is a guarantee to avoid bias and ensure objectivity and truth in evaluation. They believe that knowledge is constructed during inquiry and is necessarily embedded in the values and perceptual frames of the inquirer as well as the stakeholders. Their approach is a constructivist one, in which ‘facts’ outside of a particular framework of norms and values are considered meaningless. It is argued that evaluation outcomes represent meaningful constructions that individual actors and groups of actors form to make sense of their situations [255]. These constructions are shaped by the values of the constructors and are linked to particular physical, psychological, social and cultural contexts. In healthcare practice, evaluations are usually shaped by not considering stake-holding groups.

Because of the tradition in science, evaluations are built almost entirely on experts carrying out evaluation research. However, when we take into account the stakeholders, the question of power is included. Power aspects are crucial for understanding the questions that are considered while setting up the research. For instance, Ray and Mayan describe how questions and information are generated by the power interplay between eight major categories of actors in healthcare organizations (public or for profit), insurers (public or for profit), health professionals, regulators, the medical industrial complex, the research community, the legal system and the consumers [256].

Besides the power question, literature supports other elements. The values, preferences and perspectives of stakeholders should be considered in evaluation. It implies that evidence-based approaches (as they develop in healthcare) must be equally
concerned with ‘meaning’. Therefore, qualitative research can and should contribute to developing ‘evidence’. Qualitative forms of inquiry can contribute other forms of evidence relevant for healthcare practice that can be of equal importance as quantitative methods. According to Kvale, this type of research centres on perspectives regarding how the process occurred rather than focusing on outcomes [257]. Bogdan and Biklen reported that phenomenological survey, a type of qualitative research, involves inquiry, collection of data, descriptive reporting and interpretation which calls for creating a real world setting. It addresses the influence that context has on actions and understandings, which is crucial to the analysis of data [258].

2.7.4 Mapping and repertory grid applications

Mapping technique for measuring prescription dimension of drug adoption has been reported in literature [72]. One of the popular methods of phenomenological research is ‘cognitive mapping’. The term ‘cognitive mapping’ is used here to describe the task of mapping a person’s thinking about a problem or issue. A cognitive map is the representation of thinking about a problem that follows from the process of mapping. The maps are a network of nodes and arrows as links (a particular type of ‘directed graph’ [259-260], where the direction of the arrow implies the ‘believed causality’. Sometimes cognitive maps are known as ‘cause maps’ particularly when they are constructed by a group, and so cannot claim to be related to an individual’s cognition. However, the formalisms for cause maps will be the same as those for cognitive maps. Cognitive maps are usually derived through interviews, and so they are intended to represent the subjective world of the interviewee. Cognitive maps are not simply ‘word and arrow diagrams’, or influence diagrams (as used by system dynamicists [261], or a ‘mind-map/brain-map’ [262,263]. Mapping processes often lead to the later development of influence diagrams as a lead in to system dynamics simulation modelling [264]. Cognitive mapping is a formal modelling technique with rules for its development. The formal basis for cognitive maps derives from personal construct theory [265] which proposes an understanding of how humans ‘make sense
of' their world by seeking to manage and control it. This focus on seeking to manage and control is what gives cognitive mapping value in operational research activity. This focus on problem solving and action makes it appropriate for ‘problem structuring’ and uncovering solution options. Kelly’s theory provides the rules for mapping. Without such rules it would not be amenable to the type of analysis expected of a formal model. For cognitive maps, the causality relates the first ‘phrase’ of the bi-polar statement to the first ‘phrase’ of the second statement. When an arrow head is shown with a negative (–ve) sign attached then the first pole of the tail statement implies the second pole of the head statement [266, 267]. Typically a node (or concept) which has no implication (out-arrows) is referred to as a ‘head’, and a node which has no in-arrows is referred to as a ‘tail’. Heads will usually be ‘goal’ type statements—expressions of desired or not-desired outcomes, and ‘tails’ will be options [265–266].

When goals are expressed as not-desired outcomes, sometimes indicating disasters to be avoided at all costs, they are referred to as negative-goals. Usually, the map will contain more goal statements than those shown by heads, and more options than those shown by tails [267-269]. Maps are not just a graphical description of what is said; rather they are interpretations of what is meant by the interviewee [270]. Among the various knowledge acquisition approaches, the repertory grid method that originated from the Personal Construct theory proposed by Kelly [265] has been recognized as being very effective. Various studies have reported the effectiveness of using the repertory grid method in assisting domain experts to better organize their knowledge and experiences [271-272]. Accordingly, the repertory grid method is adopted in the clinical practice of this study. A single repertory grid for clinical practice is represented as a matrix whose columns have element labels and whose rows have construct labels [273]. Elements represent the decision to be made, objects to be classified, or concepts to be learned. Constructs are traits or features for describing or classifying the target decisions, objects or concepts [271,273].

The repertory grid method essentially requires the respondent to consider three items written on cards (known as elements) and to identify two that are alike in some
important aspect and different from the third [272–274]. In the area of personality, in which the approach was developed, the elements would be figures or people known to the respondent: the way the elements are alike is known as the similarity or emergent pole and unalike as the contrast or implicit pole [265]. As an example, two figures might be described as ‘extrovert’ (similarity), and the third as ‘introvert’ (contrast), giving an ‘extrovert–introvert’ construct dimension. The process of comparing triads is generally repeated with all of the elicited items (e.g., people), and is a way of generating psychological descriptors relevant to the area under investigation and analyzing similarities and differences in respondents’ perceptions associated with [272–274]. The repertory grid method, as classically construed to elicit personal constructs, has undergone some evolution as its use has spread within and beyond psychology and evidence related to variations in terms of how repertory grids are enacted has been noted [275–277].

This study has used a deliberately simplified version of cognitive map and the repertory grid method in order to develop an alternative method to interviews or questionnaires for generating patients’ own reasons for their treatment preferences. Researchers used both cognitive maps and repertory grid applications to provide solutions to the complexity of the diverse issues of decision-making as summarized in Table 2.3. The Table 2.3 and has been reproduced with permission (as referred in Appendix AX2, page 234).
Implementing a knowledge management framework, data mining is applied first on the patient’s data to check if medical decisions for simple diseases like hypertension...
management are dependent on doctor-patient shared decision-making. Further, using focus group interviews, employing repertory grid technique, causal mapping is constructed to show how with an increase in the disease complexity scope, shared decision-making increases. To date, channel researchers have largely focused on how information sharing affects the nature and quality of the relationship between drug suppliers and prescriber of new late-entrant drugs. The current research extends and enriches prior literature by investigating the interacting effects of institutional forces and uncertainties on information sharing.

2.8 Methods of measures for analytical model

2.8.1 SEM comparison with MLR

Structural equation modelling (SEM) has recently become a popular statistical technique to test a theory in a number of academic disciplines [286]. It is a method of multivariate statistical analysis capable of measuring the underlying latent constructs identified by factor analysis and assessing the paths of the hypothesized relationships between the constructs. Overall, SEM has two main advantages: (i) it allows for the estimation of a series, but independent, multiple regression equations simultaneously, and (ii) it has the ability to incorporate latent variables into the analysis and accounts for measurement errors in the estimation process [286-287].

In other words, SEM is a statistical technique that establishes measurement models and structural models to address complicated behavioural relationships as SEM can expand the explanatory power and statistical efficiency for model testing with one comprehensive model [288]. On the other hand, multiple regression is well-recognized for bridging the gap between correlation and analysis of variance in addressing research hypotheses [289-290].

Multiple linear regression (MLR) has evolved to a sophisticated and versatile tool for various kinds of data analyses, particularly powerful when samples exhibit
distinctive characteristics such as censorship, truncation, time series, panel or self-selection and research questions are tailored to address probability related issues [290–291].

The general model structure involves independent variables and dependent variables, assuming that independent variables cause dependent variables to change and the model error follows a certain known distribution [286–291]. The model prediction accuracy is usually measured by adjusted R², which expresses itself as a percentage. The closer the adjusted R² is to unity, the better the model prediction accuracy is. Considering the growing popularity of MLR and SEM in healthcare management research [292–297], this study has two major objectives:

- To present an example showing a contextual comparison between SEM and MLR in drug adoption managerial decision context.
- To introduce a model development strategy, focusing on testing a set of structural models after the ‘best-fitting’ measurement model has been identified.

However, MLR is not robust to measurement error and model mis-specification [292,296]. It usually assumes perfect measurement of variables, yet perfect reliability of instruments is seldom obtained in social sciences [291-292]. Therefore, the lack of observed power of predictive variables may be attributed to the lack of association between variables or may be attributed to poor reliability of measurement. Further, the selection of a set of independent variables in MLR analyses to explain the dependent variable is critical yet difficult without a sound theoretical justification.

2.8.2. SEM measurement procedures

The SEM analysis is conducted using a two-phase approach [287,297]. In the first phase, a confirmatory factor analysis is used to measure the adequacy of the measurement model [298]. Both construct reliability and item reliability are tested
After ensuring that the scale is reliable [299], the construct validity using convergent and discriminant validity is checked before the measurement model is evaluated and finalized. In the second phase, the structural model is evaluated. The overall model fit in both measurement and structural models is evaluated using goodness-of-fit indices including c/df ratio, CFI, NFI, PNFI, RFI, IFI and RMSEA [288, 297,278].

Measurement model (confirmatory factor analysis):

i. A model is a theoretical representation. Therefore, prior to any data collection, the researcher needs to specify a model that should be confirmed with sampled data. Factor analysis fundamentally presumes that, in a given domain, there is a small number of unobservable latent constructs, also known as common factors, which influence the potentially vast array of observed variables. The purpose of confirmatory factor analysis (CFA) is to statistically test the ability of the hypothesized factor model to reproduce the sampled data (i.e., usually the variance–covariance matrix). In CFA, Bagozzi and others specify a certain number of correlated factors and observed variables measuring each factor [297].

ii. Model specification is the first step in analyzing CFA. Specification involves identifying the set of relationships the researcher desires to examine and determining how to specify these variables within the model, keeping in mind that specifying a relationship requires theoretical or empirical support. In this step, the decision is made whether parameters are to be fixed or free.

iii. Fixed parameters are not estimated from the data and normally are set to zero. On the other hand, free parameters are estimated from the observed data and are expected to be non-zero. Once a CFA model is specified,
the next step is model modification. In this step, if the variance–covariance matrix estimated by the model does not adequately reproduce the sample variance–covariance matrix, the model can be refined and retested presuming the model is identifiable [297,298].

iv. Following model modification, the next step is to estimate the parameters of the specified model before attaining a specified SEM model. The overall model fit is evaluated by examining the extent to which the theoretical model is supported by the sample data. Several measures of goodness-of-fit indices are used to evaluate the measurement model [297]: c/df ratio, Normed fit index (NFI), relative fit index (RFI), comparative fit index (CFI), incremental fit index (IFI), root mean-square error of approximation (RMSEA). After achieving adequate overall fit, the measurement model is further evaluated for its reliability and validity (convergent and discriminant) following the guidelines from previous literature [286,299].

v. **Reliability**: Reliability is assessed at two levels—item reliability and construct reliability [287,297]. Item reliability indicates ‘the amount of variance in an item due to underlying construct rather than error and can be obtained by squaring the factor loadings’. An item reliability greater than 0.50 (roughly corresponds to standardized loading of 0.7) is considered an evidence of reliability. Anderson et al. indicated that the standardized loading for each item should be greater than 0.7 to demonstrate reliability but a value of 0.50 is still acceptable [287]. Construct reliability refers to the degree to which an observed instrument reflects an underlying factor. A construct reliability value of at least 0.7 is usually required.

vi. **Validity**: Having ensured that a scale instrument meets the necessary levels of reliability, the next step would be the scale validity. Validity is the extent to which a scale or set of measures accurately represents the
concept of interest [285,297]. Although there are various forms of validity, this study tested only convergent and discriminant validity.

vii. **Convergent validity:** Convergent validity assesses the degree to which dimensional measures of the same concept are correlated. High correlations indicate that the scale instrument is measuring its intended construct. Thus, items of the scale instrument should load strongly on their common construct [286,287]. The average variance extracted (AVE) as suggested by Fornell and Larcker [299] is used to assess convergent validity. Higher variance extracted values denote that the indicators are truly representative of the latent construct.

viii. **Discriminant validity:** Discriminant validity is the degree to which conceptually similar concepts are distinct. The measures of theoretically different constructs should have low correlations with each other. Therefore, a low cross-construct correlation is an indication of discriminant validity. According to Fornell and Larcker [299], discriminant validity can be assessed using the average variance extracted (AVE). To ensure discriminant validity, the average variance extracted for each construct should be greater than the squared correlations between the construct and all other constructs in the model.

The advantages of using SEM to test an empirical model have been tabulated in Table 2.4 against the disadvantages of applying it.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A model fits or fails can be ascertained</td>
<td>Latent variable is hypothetical and cannot be measured directly</td>
</tr>
<tr>
<td></td>
<td>Ideal for non-experimental data; can measure psychological data, like affection, satisfaction, dissatisfaction</td>
<td>Many different kinds of misfit can yield the same fit measures</td>
</tr>
<tr>
<td>2</td>
<td>Can be used to infer on behavioural characteristics and intangible feelings can be measured</td>
<td>SEM analysis below 200 sample size is rejected- according to Hair</td>
</tr>
<tr>
<td>3</td>
<td>Approach to data analysis involves comparing alternate theories and establishing a priori criteria and statistical indices which model best accounts for the data; evaluating model fit is less developed in other cases</td>
<td>Fit-indices sometimes do not reach cutoff. Then what fit indices to take and what should be left, needs proper justification which is a complex task.</td>
</tr>
<tr>
<td>4</td>
<td>SEM affords advantage over other methods as it accounts for random measurement error; free from measurement error</td>
<td>How to handle categorical data as binary variables truncate the magnitude of correlation; for discrete variables log linear is to be used.</td>
</tr>
<tr>
<td>5</td>
<td>invariance across subsample can be tested</td>
<td>multi-group structural equation model can be inferred</td>
</tr>
</tbody>
</table>

**2.9 Literature gap**

In view of the literature reviewed in above sections, there exist considerable knowledge gaps about the drivers of drug adoption in the context of the late-entrant generic drug prescription in India. Despite marketing communication, social relation
through word-of-mouth communication and prescription intention has been studied either singly or in intention and behavioural model. Integration of all these constructs in a single model has not been researched significantly.

While there has been some research on changes or developments in markets affecting pioneering drug adoption processes [300] and diffusion of late-entrants, the extent and quality of medical communication by firms [301], that influence the stakeholders in healthcare value chain have largely been ignored. Despite general consensus by researchers that health-related information-searching behaviour of doctors [302], drug delivery routes in patients and social influence among practicing doctors [303] are considered in prescribing new antihypertensive drugs, the nature and relative importance of marketing communication in forming adoption intent remains a subject of debate. Many empirical studies have investigated firms’ marketing efforts, which are directly related to communication among doctors, while one doctors’ influence on another’s prescription behaviour has been referred to in the diffusion literature in the context of the indirect communication of competing pharmaceutical firms.

The communication aspects of the late-entrant drug adoption can be conceptualized by comparing their perceived usefulness, instead of perceived ease of use as employed in technology adoption model. As a consequence of doctors’ perceived usefulness of the drug and their knowledge acquired through experience [304], that affects their behavioural prescription intention (PBI) through skilled and even manipulative communication, for the adoption of late-entrant brands develops [71-72]. Integrating information adoption concepts [11-12,143,281] with the perceived prescription intent dimension, needs to be linked with personal attributes and external circumstances [150,176,275,290]. However, none of the studies had reported any moderating impact of doctors’ own experience on their drug prescription intent. Moderating variable is a construct that alters the direction or strength of the relationship between a predictor (i.e., communication dimension) and an outcome (i.e., prescribing intention for late-entrant branded new drug). Such moderation [298,304-306] due to an indirect (i.e., interpersonal) communication effect (under social influence), creates a
peer-effect in medical community [71-72,97,99]. The synthesis of literature depicts that the practitioners in healthcare institution should evaluate the risk benefit of new late-entrant drug before making an adoption decision in haste and such psychometric work in this area is very limited.

Hence, after exhaustive literature survey, the prescription based drug adoption, anchored to healthcare technology adoption procedure is depicted in Figure 2.6. The diagram shows that drug adoption seems a complex mechanism and variation in decisions is a more likely phenomenon as compared to global drug adoption situation. These referred literatures can be classified based on prominent factors that emerge in studying the prescribing intentions of doctors. Interestingly, these dimensions reveal either discrete effect or lack of causal relationship to action prescription drug adoption, built into the pyramidal layers (Figure 2.6).

![Diagram of drug adoption concepts based on literature analysis](image)

**Figure 2.6: Drug adoption concepts based on literature analysis**

[Key dimensions (in pyramidal layers) connected with respective references (in rectangular tables)]
Under the above backdrops, integrating the concepts of information adoption to have a multidimensional view of drug adoption becomes highly essential. Drawing concept from Venkatesh and Morris et al.’s theory [155] and linking TPB with experience [117,303] to evaluate influence on adoption, empirical evidence demonstrated that experience moderates the relationship between subjective norms and behavioural intention [156-158]. However, the supply of healthcare information, commercial or social, is fairly unstandardized with respect to consumer characteristics.

As a consequence, physicians’ exposure to quality parameters essential to treat patients is limited. The knowledge domain of prescription drug adoption process in uncertain marketing environment has not been enriched due to the lack of implementation of communication framework based on experience level of adopters. Further, communication barriers have been identified to cause variations in these drug adoption decisions [167-169].

Moreover, few researches are spawning to improve the prescribing pattern in treating hypertension in Indian healthcare system. Among all the SAARC / BRICS countries, India represents an ideal socio-economic model where non-communicable diseases are major causes of death [2,3,4,6]. Uncertain prescription decision for new late-entrant drug, treating hypertension, seems to cause NCD spread in India. Thus, the challenging issue of spreading of uncontrolled hypertension needs to be conceptualized as the dearth of healthcare communication studies has already been pointed out by Kreps [167-169].

Finally, after studying the empirical studies, it is noted that analytical approach used is myopic to establish predictive model for drug adoption. Empirical studies of Desiraju [20], Manchanda [14] and that of Gönül and Carter [47] had been directed to measure the rate of drug adoption. Limited work on interfacing multiple research methodologies to estimate prescription intention of doctors poses a tough challenge for
the practitioners [48,53]. In the same vein, Monteiro et al. [64], while revealing doctors’ prescribing choice dimensions using multivariate tools, pointed out that confirmatory factor analysis based on structural equation modelling is highly required. Other attempts having a single view or limited number of doctors surveyed limits the scope of data triangulation. Moreover, applying single research methodology in these empirical studies prevents the researcher from having holistic view on measurement of drug adoption as revealed in Figure 2.6.

Given the dearth of existing research models, developing drug adoption scale in the presence of market uncertainty, for emerging economy like India, is highly essential. Using appropriate empirical model can be a pioneering research as data-driven studies may contribute to the body of knowledge on changing perspective of prescription drug adoption.

2.9.1 Summary

Chapter laid the theoretical foundation for studying the impact of communication on prescription drug adoption. It introduced the research problem and research issues for developing contextual propositions. To bridge the research gap, the definitions of all constructs from the literature were analyzed and synthesized keeping in view the object of this dissertation. Within the construct definitions from the literature, analysis took place empirically and the definitions were synthesized based on comparing and contrasting models relevant to the objective of this research study. In the next chapter, the research framework illustrating the relationships between the constructs and the development of research hypotheses have been presented. Chapter 3, therefore, shows the roadmap for developing a conceptual model on medical information communication. The research approach in subsequent chapters depicts the relationships among the identified constructs that impacts the adoption of late-entrant prescription drug by the doctors.