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Barriers to Adoption of Supply Chain Management in India: A Theoretical Model and Scale Development

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ABSTRACT

The diffusion of Supply Chain Management (SCM) is low in India despite its many benefits. The purpose of the present study is to create a theoretical model and develop a new scale for investigating the factors that hinder the adoption of SCM in India. The theoretical model has been created based on literature from organizational innovation adoption, organizational decision making, barrier framework, and expert opinion. The scale development followed established practices. The data for scale purification was collected through a survey conducted among 250 large manufacturing firms in India. The present study has created the first theoretical model to investigate barriers to SCM adoption in India. The model comprises four groups of factors: SCM attributes, top management factors, organizational factors, and business environment factors. A new scale was also developed that is reliable and valid. The theoretical model and the scale provide an avenue for researchers and practitioners to study the factors impacting SCM adoption in India. The model may also be useful for firms in other developing economies where SCM diffusion is low, and for barrier studies in other disciplines.

Keywords: *Supply Chain Management, Adoption, Barrier, Theoretical Model, Conceptual Framework, Scale Development, India*

1 INTRODUCTION

The modern-day concept of supply chain management has been around for over three decades now. It has been actively practiced and researched from the mid-1990s (Mentzer *et al.*, 2001; Kotzab and Otto, 2004; Giunipero *et al.*, 2008; Soni and Kodali, 2012). Firms that have adopted SCM, have reported significant benefits in the form of competitive advantage, higher revenues, lower costs due to improved operational efficiency, and higher customer satisfaction (Mentzer *et al.*, 2001; Li *et al.*, 2006; Fawcett *et al.*, 2008; Christopher, 2011; Wang, 2012; Sahu and Rao, 2015; Huddiniah and ER, 2019; Yalcin *et al.*, 2020).

Given the advantages of SCM, and based on the premise of rational decision-making by firms, it is logical to expect large-scale adoption of SCM by firms in India for utility maximization. However, large scale diffusion (number of adoptions over time) of SCM has not yet taken place in India (Sahay and Mohan, 2003; Singh *et al.*, 2010; Sahu and Rao, 2021), even though India is the third-largest economy in the world based on Purchasing Power Parity (PPP), (World Bank, 2016).

To get an idea about the order of magnitude of SCM implementations in India, a literature review was undertaken. The literature review revealed that no study has investigated the phenomenon of SCM diffusion or estimated the order of magnitude of SCM adoption in India. With literature not providing any idea on the order of magnitude of SCM implementations in India, a survey of the key SCM vendors in India (SAP, Oracle, and JDA) was conducted to get information about the number of SCM implementations undertaken by them in India. These three SCM vendors were the top three SCM software sellers worldwide, with 44.8% of market share in 2014, (Gartner, 2015). The existing and former employees of these firms were contacted. An approximate range of overall summary level numbers of SCM implementations till June 2015 was obtained after much persuasion and on condition of anonymity. Based on the information from the survey, the number of SCM implementations in India by the top three SCM vendors was 164 (SAP: 60; Oracle: 60; JDA Software: 44). Providing for implementations carried out by other SCM vendors, and home-grown deployments, the present study estimates the number of firms that are likely to have implemented SCM in India to be between 200-250. Two hundred fifty is a rather small number when compared to the number of large manufacturing firms in India. There were 1,627 firms with annual revenues of INR 500 crores or more in 2017 as per the Centre for Monitoring Indian Economy (CMIE's) Prowess database.

The lack of SCM adoption information in the literature and the insights from the survey of SCM vendors in India implies that SCM adoption is low in India. Thus, it is interesting to investigate, why a vast majority of firms have not yet adopted SCM given that the manufacturing sector in

India, is spread across 2,000 clusters across the country, and contributes about 16% of the GDP (IBEF, 2016). With the rapid increase in exports, and also in domestic consumption, and given the fact that SCM accounts for 70-80% of the cost of sales (Ballou, 2007), there is significant pressure on the firms to ensure that the supply chains are working optimally. In this background, the objective of the present study is to create a theoretical framework for studying the factors (barriers) influencing the adoption of SCM in India. The obstacles that are impeding SCM adoption will provide valuable insights to practitioners, researchers, industry bodies, and policymakers. It will help practitioners to devise ways and means to overcome them.

In the next section, the method employed in the study has been discussed. Section-3 discusses the synthesis of the theoretical model. Section-4 provides a set of hypotheses based on the model. Section-5 discusses the scale development and purification process followed. Section-6 provides a summary of the study and lists down the implications. The final section is about contribution, limitation, and future research direction.

2 METHOD AND APPROACH

The method and approach for creating the theoretical framework for studying the barriers to SCM adoption have been depicted in Error! Reference source not found..

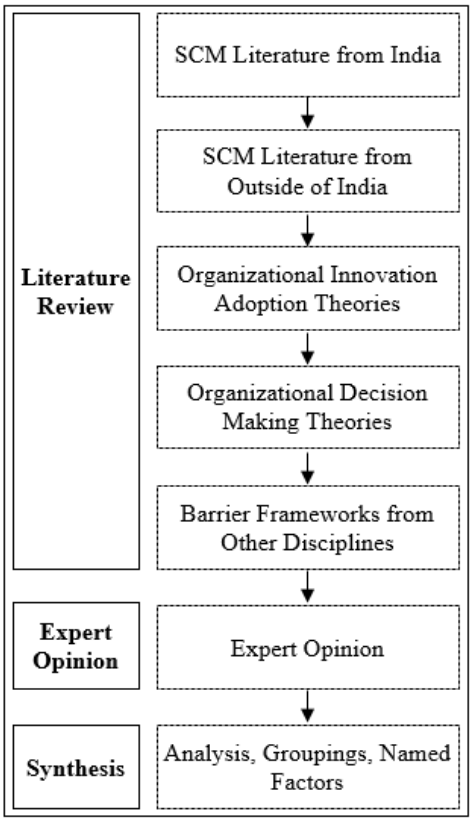

Figure 1 Method and approach used to create the theoretical method

Creating the framework involved a review of literature from various streams (SCM literature from India, SCM literature from outside of India, organizational innovation adoption literature, organizational decision-making literature, barrier frameworks from other disciplines), combining it with expert opinion and synthesizing.

2.1 SCM Literature from India

A Systematic Literature Review (SLR) of SCM studies in India from 395 articles was undertaken to find out theoretical frameworks for studying barriers to SCM adoption in India. The SLR did not yield any theoretical framework on barriers to SCM adoption. The SLR found a study on supply chain performance measurement in the automobile industry by Saad and Patel, 2006, that noted a few barriers to SCM adoption. These were: lack of understanding of SCM, structure and management style, non-collaborative working culture, poor quality of workforce skill, complex regulatory policy, and lack of infrastructure.

2.2 SCM Literature from Outside of India

A review of the literature related to SCM studies in other countries also did not yield any theoretical framework for studying barriers to SCM adoption. There are not many studies that have investigated the SCM adoption barriers. A couple of studies (Manzouri *et al.*, 2010 Malaysia and Iran; and Jabbour *et al.*, 2011 in Brazil) have identified a few barrier factors. Manzouri *et al.*, 2010, collated twenty-two barriers to SCM implementation from a review of the literature and tested these empirically. They found that lack of SCM expertise; and lack of awareness about SCM, as the two major barriers to SCM implementation in both Malaysia, and Iran. A study of the electro-electronic sector in Brazil found two factors that influenced the adoption of SCM practices. These were: the company's position; and its bargaining power (Jabbour *et al.*, 2011).

Another barrier study on effective supply chain management (not SCM adoption barriers) was carried out by Fawcett *et al.*, 2008. The barriers identified were: inadequate information systems; lack of clear alliance guidelines; inconsistent operating goals; lack of shared risks and rewards; processes poorly costed; non-aligned measures; lack of willingness to share information; organizational boundaries; measuring supply chain contribution; measuring customer demands; lack of employee empowerment; and lack of resources for SCM.

2.3 Organizational Innovation Adoption Theories

Innovation adoption has been extensively researched and documented for over fifty years now. The focus of the organizational innovation adoption studies has been primarily to understand either the: diffusion process at the aggregate level (diffusion model); or determinants of adoption decision for an individual case (adoption model) (Frambach *et al.*, 1998). The factors for innovation adoption have been studied predominantly from three angles: 1) innovation attributes (such as perceived advantage, compatibility, complexity, risk, etc.); 2) organizational attributes (firm size, organizational structure, slack resources, culture, etc.); and 3) business environment attributes (the intensity of competition, institutional pressure, industry characteristics, regulations, supplier's marketing activities, etc.).

The innovation adoption theories reviewed in the present study include: Diffusion of Innovation (DOI), Technology Organization Environment (TOE) framework, the Frambach model of organizational innovation adoption,

and the Crossan and Apaydin's framework of organizational innovation.

2.3.1 Diffusion of Innovation (DOI)

Diffusion is defined as the rate of spread of an innovation over time. The diffusion process comprises four elements. These are: 1) the innovation; 2) the communication channels used to introduce the innovation; 3) to a social system; 4) over time (Rogers, 1962, 1983, 2003). As per DOI, the adoption of an innovation in an organization is based on innovation characteristics and organizational characteristics. Rogers (1962), identified five innovation characteristics that impact the rate of adoption. These are: 1) relative advantage; 2) compatibility; 3) complexity; 4) trialability; and 5) observability. Tornatzky and Klein (1982), provided empirical support for compatibility, relative advantage, and complexity as impacting innovation adoption. They found that compatibility and relative advantage had positive impacts on adoption, while complexity had a negative impact on adoption. The dependent variable most frequently studied was organizational innovativeness (Rogers, 1983).

2.3.2 Technology Organization and Environment (TOE) Framework

Tornatzky and Fleischer (1990), proposed the Technology Organization and Environment (TOE) framework for the adoption of technological innovation. Technological innovation includes both products and process innovations depending upon whether the innovation is considered terminal (end product) or instrumental (facilitating an end product). As per the TOE framework, three sets of contexts influence the adoption of technological innovation. These are the technological context, the organizational context, and the environmental context. Factors related to technological context pertain to both the availability and characteristics of internal and external technologies relevant to the firm. The characteristics include compatibility and complexity. Factors related to the organization context identified were: firm size, structure-centralization, formalization, complexity; quality of human resources; slack resources; formal and informal linking structures, internal communications, and decision making. External task environment factors included: the industry, the intensity of competition, access to relevant technology support infrastructure in the industry, and Government regulations. TOE framework has been used quite extensively by researchers for Information Technology adoption at the organizational level. Oliveira and Martins (2011), provide a comprehensive listing of such studies.

2.3.3 Frambach Model of Organizational Innovation Adoption

The innovation adoption models, have focussed mainly on the adopter side variables, and not considered the supply side variables to explain the innovation adoption decision (Frambach, 1993; Mikl-Horke, 2004; Ozer and Acikdilli, 2012). Frambach *et al.*, 1998, empirically examined an innovation that comprised both the adopter side variables and the supply-side variables. The adopter side variables were: perceived innovation characteristics, adopter characteristics, network participation, competitive environment, and information. The supply-side variables were: marketing strategy and innovation development. A comparison of the full model (adopter side + supplier side) with the adopter side model concluded that the full model had better explanatory power than the adopter side model, thus demonstrating that the supply side factors are also crucial in adoption studies. The factors: perceived relative advantage, complexity, and supplier marketing strategy (positioning and risk reduction) were found to have a significant effect on innovation adoption.

2.3.4 Crossan and Apaydin's Framework of Organizational Innovation

Crossan and Apaydin, 2010, carried out an SLR of 524 articles on innovations over 27 years (1981 to 2008). They did not find any overarching framework for organizational innovation. They noted that the literature on management innovations was a mere 3% (n=524). They proposed a new theoretical framework to study organizational innovation based on upper echelon theory, resource-based view, dynamic capability theory, and process theory. The major determinants of their framework were: 1) leadership: chief executive officer's, top management team's ability and motivation to innovate; 2) managerial levers: mission, goals, and strategy; structure and systems; resource allocation; organizational learning and knowledge management; and organizational culture; 3) business processes: initiation and decision-making; portfolio management; development and implementation; project management; and commercialization. This framework has not been empirically tested.

2.4 Organizational Decision-Making Theories

2.4.1 Transaction Cost Economics

Transaction Cost Economics (TCE), propounded by Coase (1937), and popularized by Williamson (1975), has been one of the dominant theoretical lenses used in SCM research (Defee *et al.*, 2010; Liao-Troth *et al.*, 2012). TCE proposed "hierarchies" as an alternative governance structure to "markets" for coordinating economic transactions. The theory advocates efficient alignment or minimizing the transaction costs, and explains the existence of firms and their sizes. Determinants of transaction costs are due to attributes of the transaction (uncertainty, frequency of use, asset specificity); and human behavior (bounded rationality, and opportunism). Williamson, 2008, found SCM as an efficient hybrid governance structure between the two ends of the continuum of markets and hierarchies.

Ketchen and Giunipero, 2004, point out that transaction through a hierarchy (make) is predictable, requires significant capital outlays, and reduces flexibility. On the other hand, the same transaction arranged through the market (buy) reduces predictability, does not require a substantial investment, and provides flexibility. A well-designed supply chain (hybrid structure) with adequate continuity preserving safeguards, such as a penalty for premature termination, information disclosure, and verification procedures, specialized dispute resolution mechanism (Williamson, 2008), will provide predictability, flexibility, and low capital investment. Thus, a supply chain as a hybrid structure captures the advantages of both, the market, and the hierarchy structures at a lower risk. Firms should adopt it to lower their transaction costs.

2.4.2 A Behavioural Theory of the Firm

The behavioural theory of the firm (Cyert and March, 1963), explains how firms make economic decisions. An organization's decision-making can be understood by analyzing its goals, expectations, and organizational choices. The four key ideas of this theory are: 1) quasi-resolution of conflict (conflicting goals, bounded rationality, and imperfect environmental matching); 2) uncertainty avoidance; 3) problemistic search (motivated, simple-minded and biased); and 4) organizational learning.

2.4.3 Resource-Based View

According to Resource-Based View (RBV), possession of resources within a firm that are Valuable, Rare, Inimitable, and Non-Substitutable (VRIN) leads to sustained competitive advantage. The three categories of firm resources are physical capital resources, human capital resources, and organizational capital resources (Barney, 1991). Based on its pool of resources, firms pursue value-creating strategies to exploit opportunities present in the market for improving efficiency and effectiveness. SCM qualifies for a VRIN resource. The combination of capabilities of the different firms that form a supply chain provides the chain, and all the firms in it a unique ability. The uniqueness arises from the resources, facilities, supplier network, collaborative arrangements within and between the firms, culture, knowledge, and skill levels the firms in the supply chain pool together. Thus, the adoption of SCM can provide a competitive advantage to a firm.

2.4.4 Dynamic Capability Theory

Dynamic capability is defined as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece *et al.*, 1997, pp. 516). The business environment today is highly dynamic due to rapidly changing customer preferences, shorter product life cycles, technological advancements, and intense competition. The adoption of SCM provides a firm with the dynamic capability needed to either defend or exploit market situations to its advantage. SCM adoption leads to dynamic capability creation based on assimilated past learnings. This helps in creating new capabilities and value offerings that can be used to either defend or exploit market situations to the firms' advantage.

2.4.5 Institutional Theory

The institutional theory argues that organizational decisions (such as, to adopt SCM or not?) are not based purely on rationality and efficiency reasons. Instead, organizations seek social acceptance and legitimacy in the environment and context in which they operate (DiMaggio and Powell, 1983). There are three types of institutional forces that act on firms and influence their decision-making. These are: 1) coercive pressure by influential firms in the industry; 2) mimetic pressure by a firm's inability to deal with uncertainty and trying to learn and copy other firms; and 3) normative pressures by commonly established standards and practices by a group, industry, or profession in which the firm operates. Coercive pressure is exerted through resource dependence (Teo *et al.*, 2003) and rules and regulations. Mimetic pressure originates from uncertainty (in the market, technology, environment, goals) faced by a firm. In such cases, there is considerable confusion regarding finding a coping mechanism and firms try to imitate other firms. Haunschild, 1994, empirically observed that mimetic behavior was strengthened when uncertainty was high. Normative pressure emanates from professionalization. And is operationalized through professional association (networks), (Lee and Pennings, 2002).

2.4.6 Upper Echelons Theory

An organization is a reflection of its top managers (Cyert and March, 1963). The cognitive base, values, and bounded rationality of the Top Management Team (TMT) play an important role in evaluating a firm's context/ environment, and influence decision-making of strategic choices, which in turn impacts its performance. The decision to adopt SCM or not is one such strategic choice faced by a firm. The decision-makers are the TMT. Their psychological cognitive base and values have a bearing on the adoption decision. As the psychological cognitive base, and values, are not easily measurable, the demographic characteristics of age, formal educational level, functional background, tenure, and international experience, are some of the proxies for cognitive base and values (Hambrick and Mason, 1984). Hambrick also suggested studying the influence of culture and institutional forces on TMT behaviour and organizational outcomes.

2.5 Barrier Frameworks

2.5.1 EOGI Framework

Hueske and Guenther, 2015, examined the barrier factors of innovations from 188 empirical studies over 30 years. They found that research on barriers to innovation adoption was fragmented. They have proposed a theoretical model called the EOGI barrier model based on four meta-constructs: External environment, Organization, Group, and Individual. The constructs of the four meta-constructs are: 1) external environment (external stakeholders: investor, potential employee, supplier, competitor, customer, state, and society); 2) organization (managerial levers of dynamic capabilities: strategy, structure, size, resources, organizational learning, and organizational culture); 3) group (team structure, team climate, team processes, the composition of members depending on their characteristics, and leadership style), 4) individual (managers' attitudes and abilities, and employees' attitudes and skills). This model has not been empirically verified.

2.5.2 Other Barrier Frameworks

The Oslo Manual (OECD, 2005), listed three categories of barriers to organizational innovation based on their survey findings. These categories were: 1) cost factors (excessive perceived risks, cost too high, lack of funds within the enterprise); 2) knowledge factors (deficiencies in the availability of external services, the attitude of personnel towards change, the attitude of managers towards change, the managerial structure of enterprise); and 3) other (no need to innovate due to earlier innovations), (OECD, 2005).

The National Manufacturing Competitiveness Council (NMCC), and the National Association of Software and Services Companies (NASSCOM), carried out an exhaustive study on Information Communication Technology (ICT) adoption in the Indian manufacturing sector in 2010 based on 508 firms. The study specifically focused on Micro,

Small, and Medium Enterprises (MSME). The challenges faced by the MSMEs were categorized under three broad categories. These were: 1) firm-level challenges (lack of awareness of benefits; lack of internal IT expertise; lack of business process expertise; lack of budget; lack of affordable solutions; lack of qualified service providers; and lack of local language software); 2) ICT provider challenges (high cost of sales; high piracy rate; diverse needs of MSME; inability to scale); and 3) policy and infrastructure challenges (poor internet connectivity; unreliable power supply; financing; lack of policy clarity on innovations; data security issues), (NMCC and NASSCOM, 2010).

Souza and Bruno-Faria (2013), investigated barriers to organizational innovations in Brazil based on case studies of three organizations. They found twelve barriers. These were: 1) scepticism about the innovation; 2) difficulties of inter-functional integration; 3) excess of activities and lack of time; 4) lack of support from senior managers; 5) limitations in terms of human resources; 6) limitations in terms of financial resources; 7) limitations in terms of technological resources; 8) obstacles from the external environment; 9) prioritization of end and/or short-term activities; 10) fear of the consequences of innovation; 11) resistance to the innovation because of loss of power; 12) resistance to the innovation due to a sense of accommodation.

A study of barriers to Radical Innovations (RI), based on an extensive literature review of 103 articles by Sandberg and Aarikka-Stenroos, 2014, points out that RI barriers are a complex phenomenon, and researchers have a limited understanding of them. Their study classified the RI barriers into six main types: two external and four internal to a firm. The two external barriers were: 1) resistance or lack of support from specific actors (customer resistance, unsupportive Government, the paucity of external finance, and rivalry), and 2) restrictive macro environment (undeveloped network and ecosystem, technological turbulence, inappropriate infrastructure, and restrictive local culture). The four internal barriers are 1) restrictive mindset, 2) lack of competencies (lack of discovery competencies, lack of incubation competencies, lack of acceleration and commercial competencies), 3) insufficient resources, and 4) unsupportive organizational structure.

2.6 Expert Opinion

After considering the theoretical bases from literature, expert opinion on the subject was obtained from three SCM experts on factors that hinder adoption decisions. Several rounds of discussions were held with the experts individually. The experts have between 15 and 20 years of SCM experience (as consultant, and practitioner). This has been done to alleviate the concern raised by many researchers that in the field of SCM, theory lags behind practices (Cooper *et al.*, 1997; Burgess *et al.*, 2006; Ellram and Cooper, 2014).

The discussions with the experts resulted in the identification of several factors that are likely influencing the (non) adoption of SCM by firms in India. These are: 1) national context: regulations, taxes, infrastructure; 2) lack of top management support; 3) firm type and ownership; 4) low scale and complexity of operations; 5) lack of SCM skills and competencies; 6) lack of opinion leaders and change agents; 7) lack of marketing efforts by SCM vendors; 8) lack of supply chain orientation (SCO); 9) lack of collaborative culture; 10) good firm performance in the past; 11) lack of Program Management Office (PMO); and 12) lack of slack resources.

3 SYNTHESIS OF THE THEORETICAL MODEL

The summary of the conceptual factors from literature and expert interviews are listed in Error! Reference source not found..

Table 1 Summary of conceptual factors from literature and expert opinion

Sl #	Constructs	1	2	3	4	5	6	Authors
1	SCM/Innovation characteristics (perceived advantage, complexity, compatibility, risk, cost)		x	x	x	x		Rogers, 1962, 2003; Williamson, 1975; Tornatzky and Klein, 1982; Ramamurthy, 1990; Barney, 1991; Frambach *et al.*, 1998; Ketchen and Giunipero, 2004; OECD, 2005; Leichter, 2006; Williamson, 2008; Fawcett *et al.*, 2008; NMCC and NASSCOM, 2010; Kotler and Keller, 2016
2	Technology availability			x				Tornatzky and Fleischer, 1990
3	Scepticism about innovation					x		Souza and Bruno-Faria, 2013
4	Fear of the consequences of innovation					x		Souza and Bruno-Faria, 2013
5	Lack of Awareness / Understanding	x	x			x		Saad and Patel, 2006; NMCC and NASSCOM, 2010; Manzouri *et al.*, 2010
6	Top Management Team (TMT) characteristics			x	x	x	x	Hambrick and Mason, 1984; Crossan and Apaydin, 2010; Souza and Bruno-Faria, 2013; Hueske and Guenther, 2015
7	Top Management Support	x		x		x	x	Rogers, 1962, 2003; Saad and Patel, 2006; Crossan and Apaydin, 2010; Souza and Bruno-Faria, 2013; Sandberg and Aarikka-Stenroos, 2014
8	Supply Chain Orientation (SCO)		x				x	Mentzer *et al.*, 2001; Expert Opinion

Table 2 (con`t) Summary of conceptual factors from literature and expert opinion

Sl #	Constructs	1	2	3	4	5	6	Authors
9	Strategy			x		x	x	Ramamurthy, 1990; Crossan and Apaydin, 2010; Hueske and Guenther, 2015
10	Slack Resources (Capital, Skilled People, Managerial Talent, Technology, Organizational Time)		x	x	x	x		Rogers, 1962, 2003; Barney, 1991; OECD, 2005; Fawcett *et al.*, 2008; NMCC and NASSCOM, 2010; Souza and Bruno-Faria, 2013; Sandberg and Aarikka-Stenroos, 2014; Hueske and Guenther, 2015
11	Knowledge & Learning / Dynamic Capability			x	x	x		Cyert and March, 1963; Teece *et al.*, 1997; Hansen and Wernerfelt, 1989; Crossan and Apaydin, 2010; Hueske and Guenther, 2015
12	Skill / Competency / Expertise / Capability	x	x		x	x	x	Barney, 1991; Saad and Patel, 2006; NMCC and NASSCOM, 2010; Manzouri *et al.*, 2010; Souza and Bruno-Faria, 2013; Sandberg and Aarikka-Stenroos, 2014; Hueske and Guenther, 2015
13	Culture	x	x	x		x	x	Saad and Patel, 2006; Fawcett *et al.*, 2008; Crossan and Apaydin, 2010; Hueske and Guenther, 2015
14	Resistance / Poor Collaboration		x	x		x		Leichter, 2006; Fawcett *et al.*, 2008; Souza and Bruno-Faria, 2013
15	Communication			x				Tornatzky and Fleischer, 1990
16	Business Environment (Environmental dynamism, complexity, hostility)			x		x	x	Tornatzky and Fleischer, 1990; Ramamurthy, 1990; Souza and Bruno-Faria, 2013; Sandberg and Aarikka-Stenroos, 2014; Hueske and Guenther, 2015
17	National Context: Policy and infrastructure challenges	x				x	x	Saad and Patel, 2006; NMCC and NASSCOM, 2010; Sandberg and Aarikka-Stenroos, 2014
18	Institutional Pressure (Mimetic, Coercive & Normative)		x	x	x			DiMaggio and Powell, 1983; Haunschild and Miner, 1997; Lee and Pennings, 2002; Teo *et al.*, 2003; Leichter, 2006
19	Marketing Strategy			x			x	Frambach *et al.*, 1998; Leichter, 2006
20	Past Performance			x				Patterson, 2002
21	Inter-organizational Factors (trust, perceived opportunistic behaviour, inter firms market orientation)		x	x				Fawcett *et al.*, 2008
22	External Stakeholder					x		Hueske and Guenther, 2015
23	No business case (for sustainable global SCM practices)						x	Expert Opinion
24	IT Systems		x			x		Fawcett *et al.*, 2008
25	Organization structure			x		x		Rogers, 1962, 2003; Tornatzky and Fleischer, 1990; OECD, 2005; Crossan and Apaydin, 2010; Sandberg and Aarikka-Stenroos, 2014; Hueske and Guenther, 2015
26	Size / Scale and Complexity			x		x	x	Rogers, 1962, 2003; Tornatzky and Fleischer, 1990; Frambach *et al.*, 1998; Hueske and Guenther, 2015
27	Operating Goals (Inconsistent)		x					Fawcett *et al.*, 2008
28	Measurement (Non-Aligned)		x					Fawcett *et al.*, 2008
29	Firm Ownership						x	Expert Opinion

Table 3 (con`t) Summary of conceptual factors from literature and expert opinion

Sl #	Constructs	1	2	3	4	5	6	Authors
30	Company's position in the supply chain		x					Jabbour *et al.*, 2011
31	Individual			x		x		Hueske and Guenther, 2015

(1: SCM Studies (India); 2: SCM Studies (Outside India); 3: Innovation Adoption Studies; 4: Organizational Decision Making Studies; 5: Barrier Studies; 6: Expert Opinion).

Based on a comprehensive analysis of the factors collated from theoretical bases, and those identified from in-depth expert interviews, a new theoretical framework for the study of barriers to SCM adoption in India has been proposed in this study (Error! Reference source not found.).

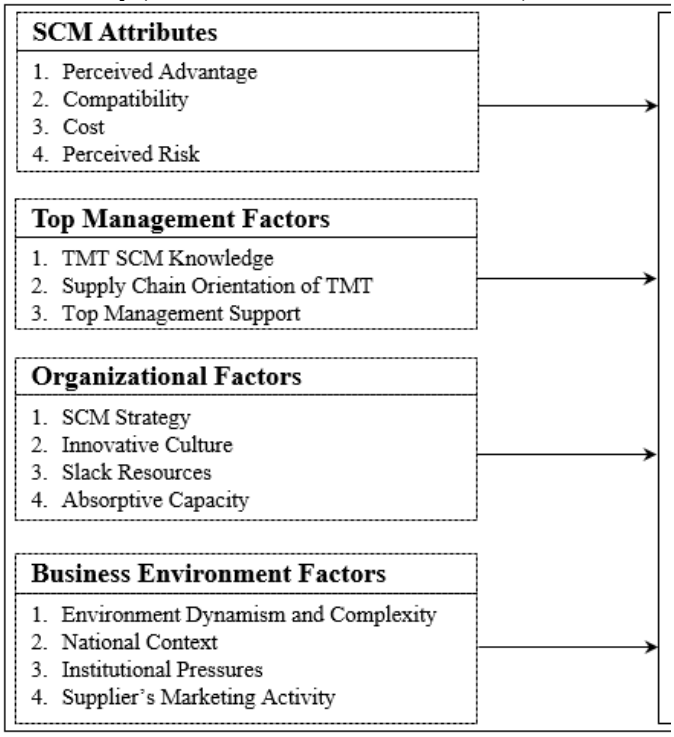

Figure 2 Proposed theoretical model for SCM adoption

The theoretical model depicts the influence of four categories of meta constructs (SCM attributes, top-management related factors, organizational factors, and business-environment related factors) on adoption intent, the dependent variable in this study. The dependent variable in most of the early innovation adoption studies (from the 1950s to 1990s) was organizational innovativeness (Rogers, 1983), and adoption status (dichotomous variable: adopted or not adopted), (Frambach and Schillewaert, 2002). However, several researchers have pointed out that adoption status provides a limited understanding of the entire process, (Rogers, 2003), and have instead suggested the extent of implementation, (Wolfe, 1994). Adoption intent has also been considered as a dependent variable in many studies (Chin and Gopal, 1995; Shu-chuan, 2001; Leichter, 2006; Heidenreich and Spieth, 2013; Hsu *et al.*, 2014).

The constructs: SCM characteristics, lowering transaction costs, technology availability, scepticism about innovation, fear of the consequences of innovation, and lack of awareness (from Error! Reference source not found.) have been used to form the meta construct "SCM Attributes" in the theoretical model. The constructs: TMT characteristics, top management support, and supply chain orientation (from Error! Reference source not found.) have been used to form the meta construct "Top Management Factors" in the theoretical model. The constructs: strategy, knowledge and learning, dynamic capability, skill, competency, expertise, capability, culture, resistance, poor collaboration, and communication (from Error! Reference source not found.), have been used to form the meta construct "Organizational Factors" in the theoretical model. The constructs environmental dynamism, complexity, hostility; national context, institutional pressure, network externalities, and marketing strategy (from Error! Reference source not found.), have been used to form the meta construct "Business Environment Factors" in the theoretical model. For keeping the theoretical model parsimonious, some of the constructs in Error! Reference source not found. were not used. Based on the proposed theoretical model, a set of hypotheses have been postulated.

4 RESEARCH HYPOTHESES

4.1 SCM Attributes

An innovation (like SCM) is adopted in anticipation of accruing some benefits. The higher the perception of the benefits of SCM in a firm, the higher will be the intention to adopt it. Similarly, the higher the compatibility of the SCM with existing systems, processes, and culture, the higher will be its adoption. SCM is complex due to its cross-functional nature and boundary-spanning processes across the firms in the supply chain (Cousins *et al.*, 2006; Kotzab *et al.*, 2011). The higher the complexity, the lower will be its adoption. Cost is another factor. The higher the cost of ownership, the less likely is its adoption. Even though innovations are expected to provide new benefits, they are also fraught with risks. The higher the risk, the less likely, is the adoption.

It is thus proposed that the SCM attributes: relative advantage, compatibility, cost, and perceived risk will influence the SCM adoption intention in firms. The corresponding set of hypotheses (alternate) are:

- $H_{a-(1)}$: The perceived advantage of SCM will influence the intention to adopt it.
- $H_{a-(2)}$: The compatibility of SCM with existing processes and systems will influence the intention to adopt it.
- $H_{a-(3)}$: The cost of ownership of SCM will influence the intention to adopt it.
- $H_{a-(4)}$: The risk of failure associated with SCM will influence the intention to adopt it.

4.2 Top Management Factors

The TMT is a small group of key persons in a firm who chart out the course of an organization. It is responsible for running the firm through planning, organizing, staffing,

directing, and controlling (Koontz, 1958). It decides on: 1) the long term and near term goals and creates a business strategy; 2) creates the management processes to run the business; 3) creates a suitable organizational structure and staffs it; 4) allocates all resources required for putting the strategy into action; and 5) influences the firm's culture to support the organizational activities.

4.2.1 Top Management SCM Knowledge

Supply chain processes are highly complex. The TMT's understanding of the capabilities, and benefits of SCM, and knowledge about how to leverage these capabilities in various contexts and scenarios, will determine how likely the firm is expected to acquire SCM. Thus, it is argued that a higher level of knowledge about SCM in the top management will lead to a higher intent to adopt SCM. The corresponding hypothesis (alternate) is:

- $H_{a-(5)}$: Knowledge about SCM by top management will influence the intention to adopt SCM.

4.2.2 Supply Chain Orientation of TMT

Supply Chain Orientation (SCO) is considered to be a vital antecedent of SCM (Mentzer *et al.*, 2001; Min and Mentzer, 2004; Esper *et al.*, 2010). SCO is a shared understanding by all the functions within a firm about the importance of managing all activities and processes in a firm cutting across functions to create a smooth flow of products, information, and money. Once the top management understands and believes in this shared understanding (SCO), it will be able in a better position to influence the thought process of the functional heads and create SCO within the firm. It is argued that the SCO of the top management team will lead to a higher intent to adopt SCM.

- $H_{a-(6)}$: The top management team's supply chain orientation (TMT SCO) will influence the intention to adopt SCM.

4.2.3 Top Management Support

Top management, being in the driving seat, is the appropriate body in the organization to foster and create the necessary culture and environment that is conducive for SCM adoption. For SCM to be successful in a firm, the top management must create an SCM strategy in alignment with the corporate strategy; creates the required organizational structure; ensures allocation of appropriate resources; communicates organization-wide about the changes and the rationale for it; carries out the change management (breaking departmental silos, creating cross-functional teams, instituting incentives and reward schemes, and resolving issues); and takes ownership of the SCM initiatives (Cooper *et al.*, 1997; Burgess *et al.*, 2006; Sandberg and Abrahamsson, 2010; Poirier *et al.*, 2010; and Kotzab *et al.*, 2011). If this support from the top management is not actively forthcoming, then it becomes a huge barrier to the adoption of SCM. Poirier and Quinn (2006), found that one of the critical factors for SCM success was visible, and active senior management commitment to outcomes. This was based on a survey of 120 respondents from North America, Europe, and Australia, representing 18 industries. Based on the above discussion, it is argued that that top management support is a critical factor that will decide whether a firm will decide to adopt SCM or not. The corresponding hypothesis (alternate) is:

- $H_{a-(7)}$: Top management support and commitment will influence the intention to adopt SCM.

The constructs' top management support, TMT SCM knowledge, supply chain orientation of TMT are related. It is argued that: 1) higher level of SCM knowledge will lead to a higher supply chain orientation of TMT; 2) higher level of SCM knowledge will lead to higher top management support for SCM adoption intent, and 3) higher level of supply chain orientation of the TMT will lead to higher top management support for SCM adoption intent. The corresponding hypotheses (alternate) are:

- $H_{a-(8)}$: Knowledge about SCM by top management will influence the supply chain orientation (SCO) of top management.
- $H_{a-(9)}$: Knowledge about SCM by top management will influence top management's support for SCM adoption.
- $H_{a-(10)}$: TMT Supply chain orientation (SCO) will influence top management's support for SCM adoption.

4.3 Organizational Factors

4.3.1 SCM Strategy

A strategy is one of the crucial factors that influence the performance of an organization. It involves specifying the steps of how the goals and objectives of an organization will be achieved by matchings the skills and resources (competencies) it possesses, and the opportunities and threats present in the external environment (Chrisman *et al.*, 1988). Three general types of strategies identified by Porter (1980) were: overall cost leadership, differentiation, and focus. Empirical evidence for Porter's strategies by Dess and Davis, 1984, concluded that companies practicing at least a generic strategy, outperform companies that do not have a strategy and are "stuck in the middle". SCM strategies commonly employed are: lean, agile, and hybrid (legile), (Fisher, 1997; Naylor *et al.*, 1999; Vonderembse *et al.*, 2006; and Poirier *et al.*, 2010). Thus, it is argued here that, firms that already have an SCM strategy or those firms that are planning to have an SCM strategy will adopt SCM.

- $H_{a-(11)}$: The presence of SCM strategy in a firm will influence the intention to adopt SCM.

4.3.2 Innovative Culture

Organizational culture is a complex phenomenon. There are several organizational culture measurement scales. The Organizational Culture Assessment Instrument (OCAI) scale by Cameron and Quinn (2011) based on the competing values framework posits that a firm's propensity to adopt innovation can be determined based on its culture type. Martins and Terblanche, 2003, identified determinants of culture which supports or inhibits innovation. These were: strategic vision and mission, customer focus, means to achieve objectives, management processes, leadership, employee needs and goals, interpersonal relationships. Denison and Fey (2003), developed and validated a model of organizational culture and effectiveness based on four cultural traits: involvement, consistency, adaptability, and mission. Dobni, 2008, indicated that innovation culture consists of seven factors. These were: implementation context, organizational constituency, organizational learning, market orientation, innovation propensity, value orientation and employee creativity, and empowerment.

Based on insight from literature, the areas of culture which can influence innovation adoption, specifically SCM adoption, are: mission, vision, and goals, marketing orientation, trust, integration, learning, innovativeness, resistance to change, and decision making. Thus, it is argued that a suitable innovative organizational culture will have a bearing on the adoption intent of SCM in a firm. The hypothesis (alternate) below reflects the same.

- $H_{a-(12)}$: An innovative organizational culture will influence the intention to adopt SCM.

4.3.3 Slack Resources

Slack resources represent the extra resources (human resources, money, technology, managerial talent, plant capacity, etc.) which an organization has at its disposal. The presence of such resources provides a firm with an opportunity to undertake improvement initiatives like management innovations (Rogers, 1982; Tornatzky and Fleischer, 1990; Damanpour, 1992; Hueske and Guenther, 2015) such as SCM adoption.

- $H_{a-(13)}$: Slack resources in a firm will influence its intention to adopt SCM.

4.3.4 Absorptive Capacity

Absorptive capacity is defined as *"the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends"* (Cohen and Levinthal, 1990, pp.128). Absorptive capacity is a very unique, and non-imitable capability of an organization that can provide a competitive advantage. However, to make commercial exploitation of the newly collected and synthesized information, the organization needs to have the capability to: 1) change its products and services or/and; 2) change the underlying systems and processes (which make these products and services) faster than the competition. A study by Johnson *et al.*, 2010, reports that organizations that are SCM leaders have a higher capacity to anticipate changes, are flexible, and are responsive to changing conditions than others. Organizations that have high absorptive capacities are likely to adopt management innovations like SCM. Thus, it is argued that firms that possess absorptive capacity will adopt SCM.

- $H_{a-(14)}$: The absorptive capacity of a firm will influence the intention to adopt SCM.

4.4 Business Environment Factors

4.4.1 Environmental Dynamism, and Complexity

Environment refers to the external business climate, competition, and Government regulations. Environmental dynamism refers to how fast the business climate is changing. It is due to changing customer preferences, technological changes, competition, substitutes, and unpredictable regulations. Environmental complexity refers to how complex the business environment is. A long value chain has a large number of suppliers, customers, products, etc., and is complex (Ramamurthy, 1990; Frambach *et al.*, 1998). Thus, it is argued that an environment that is highly dynamic, and complex is likely to influence a firm to explore new and innovative options like SCM adoption for its survival, competitive advantage, and profits.

- $H_{a-(15)}$: Environmental dynamism and complexity faced by a firm will influence its intention to adopt SCM.

4.4.2 National Context Factors

These factors are related to the country where the supply chain operates. In this study, it relates to the unique conditions prevalent in India. These can be broadly categorized as: 1) poor physical infrastructure; 2) complex taxes; 3) enforcement of contracts; 4) supplier issues; and 5) labour issues. The physical infrastructure (railway, ports, roads, warehouses, etc.) is saturated in India (Sharma and Kushwaha, 2017). India had a myriad of taxes at the centre and the state levels before the implementation of Goods and Services Tax (GST) in 2017. Enforcement of contracts is an issue with the inordinately long time taken by a slow judicial system (Chakraborty and Mandal, 2014). Labour issues such as absenteeism, strikes, etc. also can play a part. Various issues emanating from supplier's end w.r.t to quality, reliability, timeliness, and finance (Udbye, 2014), are factors that potentially have a bearing on SCM adoption. The hypothesis (alternate) proposed for the above factors are:

- $H_{a-(16)}$: The national context will influence the intention of a firm to adopt SCM.

4.4.3 Institutional Pressures (Normative, Mimetic, and Coercive)

Among the factors influencing a firm's decisions making process (on whether to adopt SCM or not) are the factors: 1) for conforming to certain norms (normative); 2) copying the actions and moves of other successful firms (mimetic); 3) acting under the pressure or threat of a trading partner (coercive). Teo *et al.*, 2003, provide empirical evidence that institutional pressures (mimetic, coercive, and normative) have an impact on the adoption of innovation based on a study of inter-organizational systems, Financial Electronic Data Interchange (FEDI). Thus, it is argued that institutional pressures have a bearing on the adoption intent of SCM in a firm.

- $H_{(a-17)}$: Institutional pressures faced by a firm will influence its intention to adopt SCM.

4.4.4 SCM Provider's Marketing Activity

The supplier's marketing activity is an important factor in the innovation adoption process (Frambach *et al.*, 1998; Frambach and Schillewaert, 2002). The SCM vendor's marketing activity has been considered as a construct from the supply side in this study. SCM vendors play a pivotal role to educate firms about all aspects of SCM. They create awareness about SCM, carry out feasibility, develop business cases, help in the adoption decision making process, help in re-engineering the appropriate business processes, choosing the relevant IT systems, SCM software, identify training, and education requirements, implement SCM and provide hand-holding post the implementation. They also share success stories of SCM implementations they have carried out with other firms, to help in assuaging the doubts and fear of trying out a radical innovation, etc. Positioning and risk reduction were two factors of SCM vendors marketing activities that were empirically found to be significant for innovation adoption (Frambach *et al.*, 1998). Thus, it is argued that the SCM provider's marketing activity is a critical factor that influences SCM adoption in firms.

- $H_{(a-18)}$: SCM provider's marketing activity will influence the intention of a firm to adopt SCM.

To summarize, a total of fifteen factors (involving eighteen hypotheses) on the adoption intent was proposed. This has been shown in **Figure 3**.

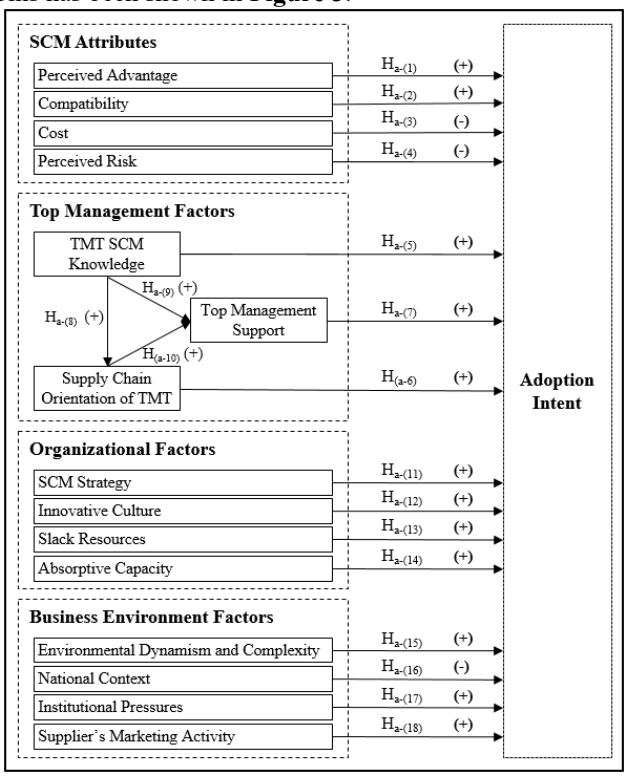

Figure 3 Theoretical model with all hypotheses

5 SCALE DEVELOPMENT

To test the proposed theoretical model (**Figure 3**), a new scale was created in the present study. The scale development followed the process laid down by Churchill, (1979); DeVellis, (2003); and Morgado *et al*., (2017). It comprised three broad steps: item generation, theoretical analysis, and psychometric analysis (Morgado *et al*., 2017) and is depicted in **Figure 4**.

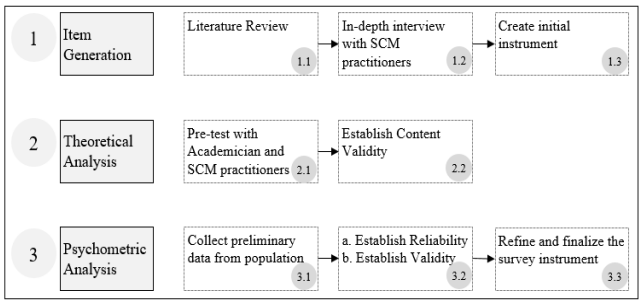

Figure 4 Scale development process used in present study

5.1 Item Generation

For item generation, both deductive and inductive methods were employed to improve the quality of the new measures, as suggested by (DeVellis, 2003). The constructs were identified from relevant literature (deductive), and interviews of SCM experts (inductive). They were operationalized through suitable measures (questions) to form the initial scale on a five-point Likert scale. Existing scales, where available, were selected, keeping in mind that they adequately covered the domain, were internally consistent and were parsimonious (Churchill, 1979). The items were also classified as existing, modified, derived, and newly proposed, similar to the classification done by Ungan, 2002.

The scale items for "SCM attributes" have been adapted from the studies of Rogers, 2003; Tornatzky and Klein, 1982; Ramamurthy, 1990; Breckon, 2009. The scale items for "top management factors" have been adapted from the studies of Hambrick and Mason, 1984; Ramamurthy, 1990; Min and Mentzer, 2004; Cohen and Roussel, 2005; Min *et al.*, 2007; Kotzab *et al.*, 2011. The scale items for "organizational factors" have been adapted from the studies of Narver and Slater 1990; Ungan, 2002; Denison and Fey, 2003; Dehning *et al*., 2004; Braunscheidel, 2005; Cohen and Roussel, 2005; Netland *et al.*, 2007; Dobni, 2008; Flatten *et al*., 2011; Prem, 2011. The scale items for "business environment factors" have been adapted from the studies of Ramamurthy, 1990; Teo *et al*., 2003; Udbye, 2014. **Table 2** provides a summary of the source references of the survey for scale items used in this study.

Table 4 Survey instrument: source reference of scale items

Item Classification	# of Items	Source Reference
Existing	12	Ramamurthy, 1990; Ungan, 2002; Denison and Fey, 2003; Dobni, 2008; Flatten et al, 2011; Prem, 2011
Modified	30	Narver and Slater 1990; Ramamurthy, 1990; Denison and Fey, 2003; Teo et al, 2003; Min and Mentzer, 2004; Braunscheidel, 2005; Netland et al, 2007; Dobni, 2008; Flatten et al, 2011; Udbye, 2014
Derived	23	Rogers, 2003; Tornatzky and Klein, 1982; Hambrick and Mason, 1984; Ramamurthy, 1990; Teo et al, 2003; Dehning et al, 2004; Cohen and Roussel, 2005; Min et al, 2007; Netland et al, 2007; Breckon, 2009; Kotzab et al, 2011
Newly Proposed	29	
Total	94	

5.2 Theoretical Analysis

An instrument is considered to have content validity when there is consensus among experts, that the instrument measures all important dimensions of the constructs to be measured based on their subjective judgements There are no numerical tests. The initial survey instrument developed was sent to ten experts in the supply chain area for content validity. The experts comprised four academicians, three supply chain consultants, and three supply chain practitioners from the industry. The feedback from the experts was used to revise the initial instrument.

5.3 Psychometric Analysis

A scale needs to be both reliable and valid for the measurement and inferences to be meaningful inferences. Reliability is the degree to which an instrument is consistent. The most common internal consistency measure is Cronbach's alpha. Researchers also frequently use composite reliability. Validity indicates how accurately the instrument measures the phenomenon it is intended to measure (Hair *et al.*, 1998). Commonly assessed validity of an instrument are:

convergent validity, discriminant validity, and nomological validity (Churchill, 1979; Hair *et al.*, 1998). Convergent and discriminant validity together form construct validity. Validity can be assessed through Multi-Trait, Multi-Method Matrices (MTMM), (Churchill, 1979), Structural Equation Modelling (SEM), (Hair *et al.*, 1998), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), or a combination of both EFA and CFA (Morgado *et al.*, 2017). The present study employed Partial Least Square (PLS) SEM on the preliminary data collected to establish the reliability and validity of the new scale created.

5.4 Data Collection

The target population for the present study is the top 1,000 manufacturing firms in India by annual revenues. As the firm size increases, the complexity of a business also increases due to several factors such as: a large number of products, customers, geography, suppliers, processes, employees, and teams. It is argued that these large firms will require SCM implementation to be able to run their businesses. The data used for establishing the psychometric properties of the scale was collected from the target population in the year 2017. A survey questionnaire was sent to 250 firms of the target population. The respondent level was specified as senior management (department head or above, representing an executive member). Department heads and above have intimate knowledge about a firm's business, including its strategy, operations, and marketing. Response from thirty organizations was received.

5.5 Scale Purification

For new scale developments, it is found that over half of the initial items get dropped in the scale refinement and purification process (Morgado *et al.*, 2017). From the data collected, the values of reliability, multi-collinearity, indicator loadings, convergence validity, and discriminant validity were examined for purifying the scale. Reliability was assessed by computing Cronbach's alpha, and composite reliability. Multi-collinearity was assessed by calculating the Variation Inflation Factor (VIF). Convergent validity was assessed by the Average Variance Explained (AVE) method, and discriminant validity was assessed by Fornell and Larcker Criterion, and Heterotrait-Monotrait (HTMT) ratio.

The purification process was iterative. Scale items were dropped one at a time and the values of reliability, multi-collinearity, indicator loadings, convergence validity, and discriminant validity were re-calculated. Of the ninety-four items on the initial scale, sixty-seven were dropped leaving twenty-seven items. The items were dropped due to lack of reliability, discriminant validity, multi-collinearity, and low indicator loading. The disposition of the scale items after the purification process is shown in **Table 5** (in Annexure-I). The final scale items and the corresponding quality parameters are provided in **Table 3**.

Table 5 Final scale - Quality parameters

Factor	Latent variables	Indicators	Loadings	Multi-Collinearity		Reliability		Convergent Validity	Discriminant Validity	
				VIF (Outer)	VIF (Inner)	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)	Fornell-Larker	HTMT
SCM Attributes	Perceptive Advantage	SCE-1	0.929	1.852	2.104	0.808	0.912	0.838	Yes	Yes
		SCE-3	0.902	1.852						
	Compatibility	SCE-4	0.897	1.492	2.836	0.729	0.881	0.787	Yes	Yes
		SCE-6	0.877	1.492						
	Cost	SCE-7	0.946	3.444	1.672	0.914	0.958	0.919	Yes	Yes
		SCE-8	0.972	3.444						
Top Management Factors	TMT SCM Knowledge	TMG-2	0.903	3.176	3.981	0.880	0.926	0.808	Yes	Yes
		TMG-3	0.932	3.836						
		TMG-4	0.859	1.947						
	TMT SC Orientation	TMG-5	0.961	2.535	3.443	0.875	0.940	0.886	Yes	Yes
		TMG-6	0.921	2.535						
	Top Mgmt Support	TSS-1	0.953	3.081	5.741	0.902	0.953	0.911	Yes	Yes
		TSS-2	0.956	3.081						
Organizational Factors	Culture	OCL-2	0.672	1.360	3.297	0.795	0.867	0.622	Yes	Yes
		OCL-3	0.811	1.563						
		OCL-5	0.770	2.031						
		OCL-6	0.887	2.734						
	Absorptive Capacity	ACT-2	0.942	4.190	3.716	0.931	0.956	0.879	Yes	Yes
		ACT-3	0.950	4.320						
		ACT-4	0.920	3.286						

Table 6 (con`t) Final scale - Quality parameters

Factor	Latent variables	Indicators	Loadings	Multi-Collinearity		Reliability		Convergent Validity	Discriminant Validity	
				VIF (Outer)	VIF (Inner)	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)	Fornell-Larker	HTMT
Business Environmental Factors	National Context	BEF-4	0.802	1.429	5.235	0.753	0.840	0.568	Yes	No
		BEF-5	0.741	1.462						
		BEF-6	0.774	1.908						
		BEF-7	0.694	1.532						
	Institutional Pressure	BEF-1	0.873	1.330	3.981	0.665	0.856	0.749	Yes	No
		BEF-2	0.857	1.330						
	Business Case by Provider	BEF-3	1.000	1.000	4.185	1.000	1.000	1.000	Yes	Yes

It can be seen from **Table 3**, that the values of indicator loadings for all the indicators except for OCL-2 (0.672), and BEF-7 (0.694) are above the cut-off limit of 0.708. The indicators OCL-2, and BEF-7 are important measures, and have been retained as indicator loadings between 0.4 to 0.7 are permitted in case of new scale development (Hair *et al.*, 2014). The cut-off limit for multi-collinearity (VIF) is 5 (Hair *et al.*, 2014). The outer VIF, for each block of variables, is within the cut-off limit. Most of the inner VIF, that measures the structural model, is also within range except for Top Management Support and National Context which are marginally higher. Examining the Cronbach's alpha, and the composite reliability, all the constructs are reliable. The convergent validity for all constructs is also established as the Average Variance Explained (AVE) is greater than the cut-off value of 0.5. The discriminant validity of all the constructs, as measured by Fornell-Larker criteria is also established, as the square root of AVE of all constructs is greater than the correlation with other constructs. From the above discussion of the quality parameters, it can be concluded that the new scale created has been empirically tested and found to be both reliable and valid.

Four of the constructs were dropped in the scale purification process. The corresponding hypotheses $H_{a-(4)}$, $H_{a-(11)}$, $H_{a-(13)}$ and $H_{a-(15)}$ were also dropped. The numbering of the hypotheses has been revised. The revised research model post scale purification is shown in

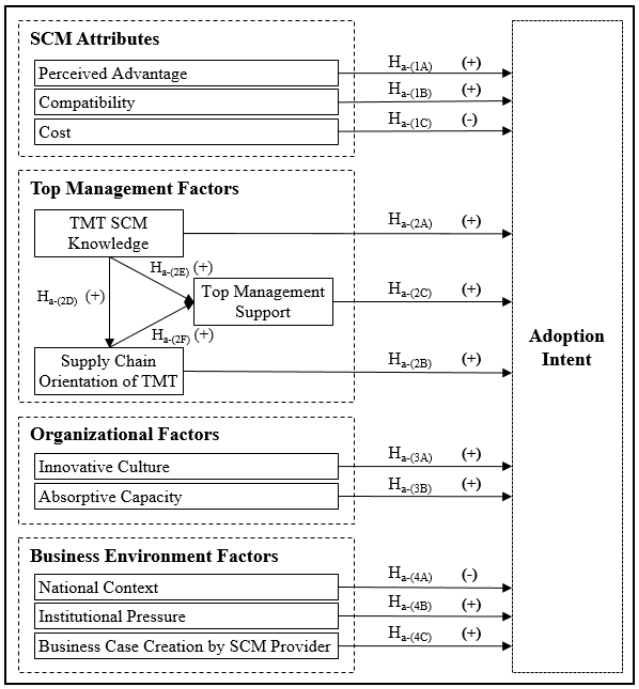

Figure 5.

Two of the constructs: institutional pressures (hypothesis $H_{a-(17)}$), and SCM provider's marketing activity (hypothesis $H_{a-(18)}$), and their corresponding hypotheses have been rephrased following the dropping of several items from their respective scales. The construct, "institutional pressures (mimetic, coercive, normative)" has been rephrased as "institutional pressure (mimetic)". Another construct, "supplier's marketing activity" has been rephrased as "business case creation by SCM provider". The two re-phrased hypotheses ($H_{a-(17)}$ and $H_{a-(18)}$) are listed in **Table 4**.

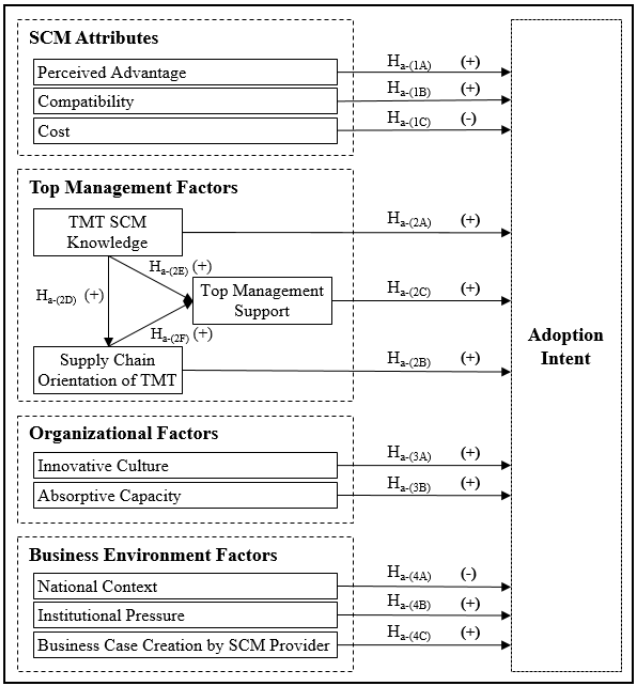

Figure 5 Final proposed research model (post scale purification)

Table 7 Revised set of hypotheses planned to be tested (post **s**cale **p**urification)

Hypothesis # (Initial)	Hypothesis # (Revised)	Hypotheses (Alternate)
$H_{a-(1)}$	$H_{a-(1A)}$	The perceived advantage of SCM will influence the intention to adopt it.
$H_{a-(2)}$	$H_{a-(1B)}$	The compatibility of SCM with existing processes and systems will influence the intention to adopt it.
$H_{a-(3)}$	$H_{a-(1C)}$	The cost of ownership of SCM will influence the intention to adopt it.
$H_{a-(5)}$	$H_{a-(2A)}$	Knowledge about SCM by top management will influence the intention to adopt SCM.
$H_{a-(6)}$	$H_{a-(2B)}$	The top management team's supply chain orientation (TMT SCO) will influence the intention to adopt SCM.

Table 8 (con`t) Revised set of hypotheses planned to be tested (post **s**cale **p**urification)

Hypothesis # (Initial)	Hypothesis # (Revised)	Hypotheses (Alternate)
$H_{a-(7)}$	$H_{a-(2C)}$	Top management support and commitment will influence the intention to adopt SCM.
$H_{a-(8)}$	$H_{a-(2D)}$	Knowledge about SCM by top management will influence the supply chain orientation (SCO) of top management.
$H_{a-(9)}$	$H_{a-(2E)}$	Knowledge about SCM by top management will influence top management's support for SCM adoption.
$H_{a-(10)}$	$H_{a-(2F)}$	TMT Supply chain orientation (SCO) will influence top management's support for SCM adoption.
$H_{a-(12)}$	$H_{a-(3A)}$	An innovative organizational culture of a firm will influence the intention to adopt SCM.
$H_{a-(14)}$	$H_{a-(3B)}$	The absorptive capacity of a firm will influence the intention to adopt SCM.
$H_{a-(16)}$	$H_{a-(4A)}$	The national context will influence the intention of a firm to adopt SCM.
$H_{a-(17)}$	$H_{a-(4B)}$	Institutional pressures faced by a firm will influence its intention to adopt SCM.
$H_{a-(18)}$	$H_{a-(4C)}$	Business case creation by SCM providers will influence the intention to adopt SCM.

5.6 Summary and Implications

5.6.1 Summary

The benefits of adopting SCM is well known. However, the diffusion of SCM in India is low and the underlying reason for non-adoption has not been studied comprehensively. Thus, the present study has developed: 1) a new theoretical model to understand the barriers hindering SCM adoption in India; and 2) developed a new instrument that is reliable and valid to measure the phenomenon.

The theoretical model was synthesized from organizational innovation adoption theories, organizational decision-making theories, barrier studies, and expert opinion. The model has four groups of factors: SCM

attributes, top management factors, organizational factors, and business environment factors.

The scale development and purification process followed the established methods for item generation, theoretical analysis, and psychometric analysis. The data for scale purification was collected from a population of the top 1,000 manufacturing firms in India by revenue. The unit of analysis was firm, and the respondent level was senior management (department head).

5.7 Implications

The present study has theoretical and practical implications. On the theoretical side, a new theoretical model, and a new instrument to study the barriers to SCM adoption have been developed. It will be useful for researchers for the study of barriers to SCM adoption in an emerging country context. Further, the theoretical model will provide useful insight for creating models about barriers/adoption in other disciplines as well. On the practical side, the study provides researchers and practitioners with a suitable instrument that can be used to study the barriers/adoption factors for SCM in India.

Using the instrument created, a future study can test the new theoretical model created in the present study. A study on SCM adoption decisions, implementation issues, and SCM performance in the context of India and a comparison with other emerging, and developed economies can be addressed in future research.

ANNEXURE-I

Table 9 Disposition of scale items after scale purification process

Meta Construct	Construct	Items	Item Status	Item Name (Final Scale)	Source Reference
1. SCM Attributes					
	Relative Advantage				
		SCM provides sustained competitive advantage	Retained	SCE-1	16, 18
		Provide higher operational efficiency	Dropped	SCE-2	16, 18
		Provide higher customer satisfaction	Retained	SCE-3	16, 18
	Compatibility				
		SCM will not match with our organizational values and belief system.	Dropped		2, 15, 16, 18
		SCM will not match with our business and operational processes.	Dropped	SCE-5	16, 18
		SCM will not match with our existing IT systems, and IT infrastructure.	Retained	SCE-6	15, 16, 18

Table 10 (con`t) Disposition of scale items after scale purification process

Meta Construct	Construct	Items	Item Status	Item Name (Final Scale)	Source Reference
		SCM will be too complicated to implement in our organization.	Retained	SCE-4	2, 15, 16, 18
	Perceived Risk				
		SCM implementation requires changes to strategy, structure, and processes that radically rearranges how work is done in an organization.	Dropped		21
		SCM implementing is not easy to achieve.	Dropped		16, 18
		Successful implementation of SCM requires sustained change management effort throughout our firm and the supply chain links for a long time.	Dropped		21
		Unsuccessful or challenged SCM implementation will result in negative financial consequences or loss of competitive position for our company.	Dropped		21
	Costs				
		The cost of implementing SCM is prohibitively high.	Retained	SCE-7	15, 16, 18
		The annual cost of maintaining the SCM implementation is very high.	Retained	SCE-8	15, 16, 18
2. Top Management Factors					
	TMT SCM Knowledge				
		Mention the level of education of the CEO	Dropped	TMG-1	8
		Extent of knowledge of the CEO about SCM	Retained	TMG-2	8
		Cumulative SCM knowledge level of the Top Management Team	Retained	TMG-3	8

Meta Construct	Construct	Items	Item Status	Item Name (Final Scale)	Source Reference
		Cumulative SCM knowledge level of the mangers at middle Management	Retained	TMG-4	8
	Supply Chain Orientation of TMT				
		Top management does not believe that our firm's survival depends on adapting to SCM.	Dropped		10
		Top management does not view our supply chain as a strategic asset.	Retained	TMG-5	3
		Top management does not believe that building, maintaining, and enhancing long-term relationships with our supply chain members are critical to our firm's success.	Retained	TMG-6	10
		Top management does not believe sharing valuable strategic/tactical information with our supply chain members is critical to our firm's success.	Dropped		10
	Top Management Support				
		Top management regularly communicates how SCM strategy is critical to attainment of the organization's vision, mission, goals and objectives.	Dropped		11
		Top management provides the resources necessary for SCM.	Retained	TSS-1	15
		Top management creates the right organization structure to implement and sustain SCM.	Dropped		21
		Top management fosters a culture conducive to SCM adoption.	Dropped		21
		Top management uses formal and informal rewards to encourage and reinforce SCM adoption.	Dropped		21
		Issues and conflicts related to SCM adoption are promptly addressed and resolved by top management.	Dropped		9
		Top management take responsibility for results and consequences of SCM adoption.	Retained	TSS-2	21
		Top management regularly finds out first-hand how SCM is faring by walking across the facilities and making observations.	Dropped		21
3. Organizational Factors					
	Strategy				
		Our company has a well-defined SCM strategy (documented)	Dropped		13
		Our SCM strategy is aligned with our customer's need.	Dropped		13
		Our supply chain strategy is aligned with our company's strategy, vision and mission	Dropped		13

Table 11 (con`t) Disposition of scale items after scale purification process

Meta Construct	Construct	Items	Item Status	Item Name (Final Scale)	Source Reference
		Our company has a clearly stated Information Communication Technology (ICT) strategy for supply chain	Dropped		13
		Our company has a set of well-defined supply chain performance measures (documented) in alignment with our SCM strategy	Dropped		21
		SCM strategy and supply chain performance measures are communicated to all employees	Dropped		21
		SCM planning is done at strategic, tactical and operational levels in synchronization with the SCM strategy	Dropped	TSS-3	21
		Our SCM strategy can adapt to changes in business environment.	Dropped		3
		Our employee's key result areas (KRAs) are in alignment with our SCM key performance indicators (KPIs)	Dropped	TSS-4	13
	Culture				
		All members have a deep understanding of customer wants and needs	Dropped		14
		We co-define value with our customers	Dropped	OCL-1	6
		Customer input directly influences our decisions	Dropped		5
		All members are driven by our beliefs about how we can create greater value for customers	Dropped		1
		Employees lack the understanding of how they and their department/function contribute to creation of customer value	Dropped		21

Meta Construct	Construct	Items	Item Status	Item Name (Final Scale)	Source Reference
		All of our business functions (e.g. marketing, manufacturing, R&D, finance) are not fully aligned in serving the needs of our customers	Retained	OCL-2	12
		Cross functional teams are established to eliminate the hand-offs across functional boundaries.	Dropped		13
		There is an unwillingness to share information between departments or functions in our company.	Retained	OCL-3	13
		Supply chain learning is considered an investment, not an expense.	Dropped	OCL-4	1
		Once we quit learning in the supply chain we endanger our future.	Dropped		1
		New and improved ways to do work are continually resisted.	Retained	OCL-5	5
		There is lack of ownership due to fear of audits.	Dropped		21
		Due to SCM, there is a fear of losing power and authority or exposure of efficiencies.	Retained	OCL-6	21
		Procrastination of decision making and approvals is prevalent.	Dropped		21
	Slack Resources				
		Capital (Money)	Dropped		20
		Skilled People	Dropped		20
		Managerial Talent	Dropped		20
		Technology	Dropped		4
		Organizational Time	Dropped		20
	Absorptive Capacity				
		The search for relevant information concerning our industry is every-day business in our company.	Dropped	ACT-1	7
		Our management emphasizes cross-departmental support to solve problems.	Dropped		7
		Our employees have the ability to structure and use collected knowledge.	Dropped		7
		Our employees successfully link existing knowledge with new insights and apply the new knowledge in their practical work.	Retained	ACT-2	7
		We can quickly facilitate changes to our products and services based on client or competitive reaction.	Retained	ACT-3	6
		We can modify systems and processes fairly quickly to a scenario as required by our SCM strategy and plans.	Retained	ACT-4	6
4. Business Environmental Factors					
	Environmental Dynamism				

Table 12 (con`t) Disposition of scale items after scale purification process

Meta Construct	Construct	Items	Item Status	Item Name (Final Scale)	Source Reference
		Predicting the changes in customer demand and tastes is very difficult.	Dropped		15
		We find it almost impossible to predict changes in competitors' actions.	Dropped		15
		Predicting the changes in our suppliers actions is very difficult.	Dropped		15
		We are seldom able to predict the actions of government and regulatory agencies.	Dropped		15
	Environmental Complexity				
		We compete with a large number of competitors.	Dropped		15
		We deal with a large number of customers.	Dropped		15
		Our customers are quite diverse in their needs and requirements.	Dropped		15
		We deal with a large number of suppliers of material & parts or vendors of equipment.	Dropped		15
	Supplier Issue				
		The quality of products and services from our suppliers is poor.	Dropped		19
		Reliability (honoring commitment) of our suppliers is poor.	Retained	BEF-4	19

Meta Construct	Construct	Items	Item Status	Item Name (Final Scale)	Source Reference
		Commitment to timeliness by our suppliers is poor.	Dropped		19
		Financial strength of our suppliers is poor.	Dropped		19
	National Context				
		Labor problems such as strikes, absenteeism, shortages, turnover is prevalent in our company.	Retained	BEF-5	21
		Complex maze of federal and state tax structures hampers efficient planning of our facilities, production and distribution.	Retained	BEF-6	19
		Tedious and long drawn process of enforcement of contracts in India is a hindrance for SCM execution.	Retained	BEF-7	21
	Institutional Pressures				
		SCM adoption by our competitors is widespread.	Retained	BEF-1	17
		SCM adoption by our suppliers is widespread.	Dropped		17
		SCM adoption by our customers is widespread.	Dropped		17
		SCM adoption by manufacturing firms in India is not widespread.	Dropped		21
		Our main competitors, suppliers and customers that have adopted SCM, are perceived favorably in the industry and market place.	Retained	BEF-2	17
		In our industry, the dominant players (customers) are not insisting their SCM policies and guidelines on other supply chain members.	Dropped		21
		Our industry associations and groups have not formulated any SCM standards or practices to be followed.	Dropped		21
	SCM Provider's Marketing Activity				
		There is no shortage of firms providing SCM products, solutions and consultancy in India.	Dropped		21
		The providers of SCM solutions rarely meet our top management to convince them to adopt SCM.	Dropped		21
		The providers of SCM solutions frequently direct their effort in convincing CIO and IT managers to adopt SCM.	Dropped		21
		The providers of SCM solutions have carried out a strategic opportunity assessment of our company and have created a business case for SCM implementation.	Retained	BEF-3	21
		The providers of SCM solutions have understood our specific business context and have agreed to provide us with customized solutions.	Dropped		21
		To learn from experiences of companies who have implement SCM, customer references were arranged by providers of SCM solutions.	Dropped		21
		The providers of SCM solutions offer trial evaluations, proof of concepts (POCs) and pilot implementations.	Dropped		21

Table 13 (con`t) Disposition of scale items after scale purification process

Meta Construct	Construct	Items	Item Status	Item Name (Final Scale)	Source Reference
		The providers of SCM solutions periodically conduct roadshows, industry workshops, and other marketing events for information dissemination about SCM implementation.	Dropped		21
		There is a good pool of external consultant talent available to carry out SCM implementations.	Dropped		21

1-Braunscheidel, 2005; 2-Breckon, 2009; 3-Cohen and Roussel, 2005; 4-Dehning et al, 2004; 5-Denison and Fey, 2003; 6-Dobni, 2008; 7-Flatten et al, 2011; 8-Hambrick and Mason, 1984; 9-Kotzab et al, 2011; 10-Min and Mentzer, 2004; 11-Min et al, 2007; 12-Narver and Slater 1990; 13-Netland et al, 2007; 14-Prem, 2011; 15-Ramamurthy, 1990; 16-Rogers, 2003; ; 17-Teo et al, 2003; 18-Tornatzky and Klein, 1982; 19-Udbye, 2014; 20-Ungan, 2002; 21-Newly Proposed

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