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Supply chain knowledge Management in Open Innovation Flows

Ali Bagheri (Ph.D. Student of Technology & Innovation Management)
Email: Aibi60@yahoo.com
ORCID: 0000-0002-0000-8366
Science & research branch of Islamic Azad University, Tehran,Islamic Republic of Iran

***Dr. Nazanin Pilevari (Ph.D.), Associate Professor**
(*corresponding author)
***Email: pilevarisalmasi.nazanin@gmail.com**
Associate Professor, Department Of Industrial Management, Tehran West Branch, Islamic Azad University

Abstract
This literature review paper has tried to collect the necessary definitions and previous reviews related to supply chain management, it has started to define the classic concept of supply chain and then have reached to one of its newest form that means supply chain knowledge management.At the end the literature review has extended to the conceptof open innovation and surveyed about supply chain knowledge management in open innovation flows. This paper has tried to have a stream review of literatures began from classic supply chain concept ,fertilized by supply chain management concept and finished by joining this concept to open innovation flows.It tried to focus on related definitions while classic or contemporary papers. This review paper could be leaded to future studies on supply chain knowledge management in open innovation strategies in knowledge- based organizations.
Keywords: Supply chain, Supply chain knowledge management, OpenInnovation, knowledge management, innovation.

1. Introduction

The origin of supply chain management referred to 20th century and its concept has announced by Forrester for the first time that generally has been used for the kinds of goods and service. There is a new point of view to supply chain management that is called supply chain knowledge management. This term has arrived from knowledge based economy and it is a newer concept in compare of classic supply chain. In this literature review, there was attempt to have a short glance on classic and recent definitions of supply chain management. Then it has focused on one of the most recent concepts that is called supply chain knowledge management. This concept has basically raised from knowledge based economy and it is necessary for researchers and students in technology and innovation management and other related fields to have a look on supply chain management from this point of view that supply chain management in knowledge flows can play an important role to have the best performance in knowledge based organizations then the reviews survey has ended by extending supply chain knowledge management to open innovation flows.The tension relating to the overlap between supply chain management and technology innovation management have been raised before in Technovation (Groen and Linton, 2010). Two separate fields claiming the same concept as their own, resulting in research on the same concept occurring independently and with limited recognition and interaction between researchers in the two different fields. This challenge occurs not only with open innovation/integratedproduct development, but also with behavior in the oppositedirection–disintermediation/disintegration. For both supply chain and technology innovation management researchers to recognize this parallel is important, as the work on disintegration and disintermediation is at an earlier stage of development than that of integration and open innovation. Consequently, whether discussion of interaction between firms is considered from the perspective of open innovation (Chesborough, 2003) or supply chaininnovationintegration,thefocusisincreasinglyon firmspursuing innovation in a coordinated fashion to provide greater value to the customer. The open innovation literature involves 1,931 articles dating as far back as 2003 (according to Scopus as of June 5th, 2018), while the supply chain product innovation literature involves fewer 140 articles dating backovera longerperiod–startingin1998 (accordingtoScopus as of June 5th, 2018). Both of these literatures promote the benefits of integration. When innovation is best described as normal, routine, incremental, continuous, sustaining, or evolutionary the tendency is for dyad partners andsupply chain partners to mutually benefit fromcloser cooperation – that is, integration. However, innovation often brings its greatest benefits when it is radical, disruptive, discontinuous or revolutionary. These innovations add value through the disintegration of

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existing supply chains – as opposed to optimization of exiting configurations. In some cases, this disintegration involves disintermediation – reducing the number of intermediaries thereby reducing the number of supply chain partners and in the process reducing the time and cost to offer product to customers. In other cases, disintegration involves changing one or more partners in the supply chain to reflect technology substitution or a change in the entire business model due to the opportunities provided by technological innovation(s). While the literature on disintegration of supply chains is relatively small 31 articles starting as far back as 1983 (according to Scopus as of June 5th, 2018), the business management literature involving disintermediation a subset of supply chain disintegration is much larger and older, 317 articles starting as far back as 1971 (according to Scopus as of June 5th, 2018). While the disintegration literature has no apparent pattern, the earlier disintermediation literature focuses on financial intermediaries and then increases with the rise of the internet and ecommerce(Linton, 2018).Applying the field of knowledge management to supply chain management through a knowledge management, provides future research inquiries pertaining to how scholars can utilize the largely ignored areas of supply chain digitisation as well as the growing areas to explain how the human dimension of supply chain management can be further explored for the purposes of optimizing supply chain digital performance (Schniederjans et al., 2020).

2. Literature Review and definitions

2.1. Supply chain

What isknown today about supply chain has raised from the Forrester definition that has said: “Management is on the verge of a major breakthrough in understanding how industrial company success depends on the interactions between the flows of information, materials, money, manpower, and capital equipment. The way these five flow systems interlock to amplify one another and to cause change and fluctuation will form the basis for anticipating the effects of decisions, policies, organizational forms, and investment choices.”(Forrester, 1958).according to dynamic systems concept, all the members in one supply chain flow, have effects on each other and it could not be studied each part of one supply chain separately without any other member effects.

2.2. Supply chain management

Terminologically, SCM (Supply Chain Management) has become such an important term on manufacturing, distribution, marketing, customer management, or transportation flows and its related articles(Cooper & Ellram, 1993).Some researchers define SCM in operation management point of view involving the flow of materials and products, as a management philosophy, or as management process(Croxton, Garcia-Dastugue, Lambert, & Rogers, 2001). Some writers have seen it as integrated system (Stewart & Stephanie, 1994). The term of “supply chain” seems to be used more by authors than term of “supply chain management” (Cooper and Ellram 1993; La Londe and Masters 1994; Lambert, Stock, and Ellram 1998La Londe, Lambert, Stock, and Ellram) define a supply chain as the alignment of firms that brings products or services to market(Stock & Boyer, 2009). these definitions of supply chain include the final consumer as part of the supply chain. Another definition announces a supply chain is the network of organizations, with some linkages, Christopher (1992)and Houlihan (1988) has saidThe supply chain is a single process and in the end depends on, strategic decision making.(Houlihan, 1988)According to Stock & Boyer (2009) supply chain management is defined as: “The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction.”(Christopher, 1992).It was announced that Supply chain management is applicable in both manufacturing and services organizations involving suppliers, suppliers of the suppliers, customers and customers of the customers. In the next sessions of this paper it will be surveyed by literature if the term of supply chain management is only about products and services (tangible items) or there are some evidences of supply chain management of intangible itemsin literature review too. It was found in literature, there are some usual fields that could prove knowledge management applications in supply chain. These fields can help us to find this point of view that in which areas KM (knowledge management) is applied in SCM. According to Table 1, the most common areas appear to be outsourcing, the construction industry, decision support, NPD (New Product Development), and risk management. Outsourcing activities appear to be the most popular area in which knowledge management can be applied to the supply chain.(Cooper, Lambert, & Pagh, 1997)(Marra, Ho, & Edwards, 2012)

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Table 1: Specific SCM areas(Marra, Ho, & Edwards, 2012)

Specific SCM areas	literature review papers	count
Outsourcing	Becker and Zirpoli (2003), Bandyopadhyay and Pathak (2007) Madsen et al. (2008) Blumenberg et al. (2009) Niemi et al. (2010)	5
New product development	Corso et al. (2001) Corso and Paolucci (2001) Becker and Zirpoli (2003) Chen et al. (2008)	4
Construction	Briscoe et al. (2001) Tah and Carr (2001) Khalfan et al. (2010)	3
Decision support	Raisinghani and Meade (2005) Koh and Tan (2006) Pedroso and Nakano (2009)	3
Risk management	Tah and Carr (2001) Xiwei et al. (2010)	2
Build-to-order	Chow et al. (2007)	1
Procurement	Yeh (2008)	1
Organizational performance	Fugate et al. (2009)	1
Open Innovation	Linton (2018) Biglardi etal.(2010)	2

2.3. Knowledge management

Before defining supply chain knowledge management extracted from our review literature, necessaryto note some different definitions of knowledge management to clarify the subject. Some different definitionshave collected as below:

a) Definition by Wiig in 1997: "Systematic, explicit, and deliberate building, renewal and application of knowledge to maximize knowledge-related effectiveness of an enterprise and return from its knowledge assets" (Wiig, 1997)
b) Definition by Davenport and Prusak in 1998: "Knowledge is a fluid mix of framed experience, important values, contextual information, and expert insight that provides a framework for evaluation and incorporation of new experiences and information." (Davenport & Prusak, 1998)
c) Definition by American Productivity and Quality Centre (APQC) in 1999: "A conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improveorganizational performance" (Clearinghouse, 1999)
d) Definition by Horwitch and Armacost in 2002: "KM is the creation, extraction, transformation and storage of the correct knowledge and information in order to design better policy, modify action and deliver results"(Horwitch & Armacost, 2002)
e) Definition by Chong and Choi in 2005: "Systematic management of organizational knowledge which involves the processes of creating, gathering, organizing, store, diffusing, use and exploitation of knowledge for creating business value and generating competitive advantage" (Chong & Choi, 2005)

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In four previous definitions it has noted to some definitions that be more useful for this paper. According to these definitions, knowledge as an intangible item, is generated, exploited, identified, absorbed,documented, and transferred between firms that all these processes could be in-flows or out-flows on the other hand internal or external. That is important to note that all the knowledge flows and its management is similar to tangible items like products and services of course with some differences that was shown by this paper.so all these logical steps have leaded authors to reach to the new term that is called supply chain knowledge management.After a brief introduction with KM definitions, as was found in literature, there is a model shown by figure 1 that it could lead us to be familiar with KM model in networks. This model can be useful for this study because makes us ready to understand about supply chain knowledge management in our network.(Spring, 2003)but before that, it is necessary for our study to have a look at definitions and literature of Supply chain knowledge management in the next partThe results show that knowledge generation, storage and application have significant and positive effect on firm innovation(Ode& Ayavoo, 2020).

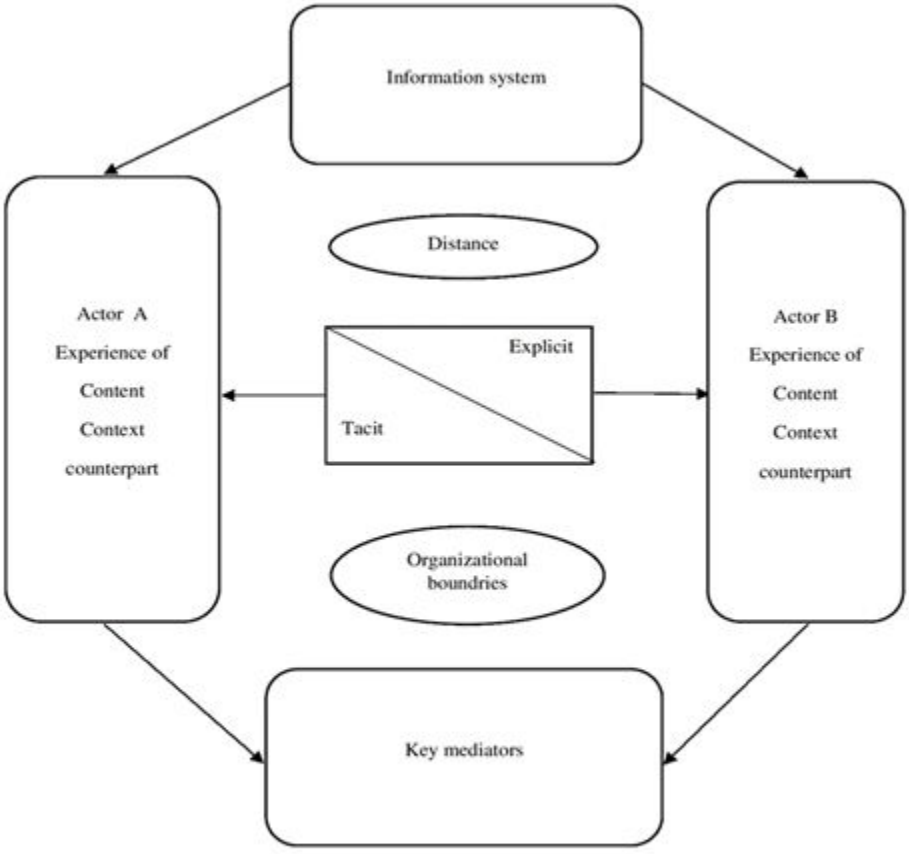

Figure 1: A model of knowledge management in networks.*(Spring, 2003)*

2.4. Supply chain of knowledge management (SCKM)

According to literature, the supply chain integration could happen bothbetween tangible (like goods)and intangibles resources such as knowledge. Knowledgecan cause value creation leads to customer satisfaction and increased share evaluation(Coulson-Thomas, 2004). Lin and Wu in 2005, suggested that relationships with customers are important to knowledge creation in a supply chain(Lin & Wu, 2005).Spring, announced the importance of the transfer of explicit and tacit knowledge throughout the supply chain(Spring, 2003).As what Desouza, has said, knowledge management systems are the life-blood of supply chains that is demonstrated the very important role of knowledge management in supply chain. So the role of knowledge management systems is unavoidable(Desouza, Chattaraj, & Kraft, 2003). KMS in supply chains have been supported by what Desouzanoted as below: “a)an aggregate supply-

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chain-wide vocabulary to ensure that the knowledge is correctly understood.b) Each constituent in the supply chain must identify, model and explicitly represent their knowledge.c) The supply chain shares and re-uses their knowledge among differing applications for various types of uses that enables sharing of existing and future knowledge sources"(Ramish & Aslam, 2016).To understand more about supply chain knowledge management, itwas extracted the KPIs for supply chain by searching in literatures. The characteristics of good KPIs for supply chains include: "a) need to go beyond internal measures and metrics and look at the supply chain as a whole.b) Need to link the supply chain performance and corporate objectives.c) Need to expand "line of sight" within the supply chain.d) Need to allocate benefits and shift burdens resulting from functional shifts within the supply chain.e) Need to encourage co-operative behavior within the supply chain.f) Need to enhance motivation, improve communication, and diagnose problems within the supply chain.g) Need to improve the performance of the supply chain and provide competitive advantage"(Ramish & Aslam, 2016).according to literature The knowledge based organization thus has the following features: Ability to Solve complex problems needs creativity , Having a large number of highly educated employees , Growing by itself rather than by acquisition ,having private partnerships rather than public forms , Building company strength through skilled personals, developing the skills of the employees ,managing by the people who are formal as well as informal leaders(Sveiby, 1997).so as a result and according to literature Knowledge supply chain can be introduced as Existence of a common system for solving complex problems arisen throughout the supply chain requiring creativity plus Existence of a high number of knowledge managementexperts plusExistence of knowledge creation as opposed to acquisitionsplus Existence of supply chain identity reflecting through the development of the knowledge degree of the employees about suppliers, contractors and customers plus Existence of intra supply chain knowledge employee transfer plus Existence of industry-academia linkages plus Existence of mutual respect of business partners (Sveiby, 1997).As figure 2,there is a relationship between KM and supply chain and competitive advantages(Sveiby, 1997).now focusing on literature review by specifically extending the concept of supply chain knowledge management to open innovation flows and before that there is need to have a quick review on open innovation concept itself in literatures.

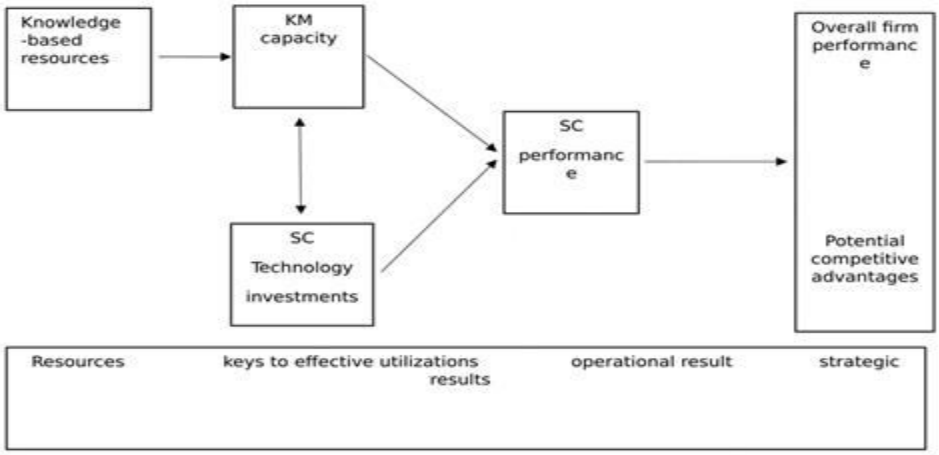

Figure 2: Link between KM, supply chain and competitive advantage(Sveiby, 1997).

2.5. Open Innovation

Traditionally, organizations have innovated by themselves for new ideas, technologies, products and processes that could create for them precious values in competition by others. The important point is that firms will miss some good situations if they focused just on their internal activities, and this is a limitation for them. But, some organizations don't limit themselves by in- flows and have shifted from a closed innovation in their inside boundaries to an open innovation, this concept has noted by Henry Chesbrough in 2003 for the first

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time(Chesbrough, 2003). The firms mix the in-bound and out-bound flows of new ideas and technologies in their innovation processes. According the literature , open innovation can come through to gaining knowledge, decreasing costs, shortening time to market, enhancing innovation performance, increasing sales and firm overall performance(Laursen & Salter, 2004)(Wang, Yeung, & Zhang, 2011)(Tomlinson & Fai, 2013)(Mentzer et al., 2001)(Huizingh, 2011).all these inside and outside flows of knowledge and new ideas could be supported by supply chain knowledge management as it was noted already in literaturereview.Openinnovationhasbeenwidelydebatedinthemanagementofinnovationliteratureoverthepastdecade(e. g.,Chesbrough,2003;Dahlander&Gann,2010;Gassmann&Enkel,2004;vonHippel,2005; Prahalad & Ramaswary, 2004; West & Gallagher, 2006). On the one hand, research has identified a number of advantages of the open innovation model, such as leveraging external knowledge inputs to accelerate internal innovations and expand the markets for externaluseofinnovation.Ontheotherhand, empiricalevidenceindicates that the returns from open innovation decrease at the margin as the costs of openness exceed the benefits (Laursen & Salter, 2006). Studieshighlightconsiderableheterogeneity in open innovation performance among companies, indicating that companies vary considerablyintheirabilitytomasterthechallengesassociatedwith openness (cf., Salge, Bohne, Farchi, & Piening, 2012). Perhaps due to a lack of systematic evidence on inter-company heterogeneity in open innovation performance, little is known about the factors that help distinguish organizations capable of reaping the benefitsof openinnovationfromthosethatarelesscapable(Huizingh, 2011). A priori many factors may account for such heterogeneity,suchasproductcomplexity(Almirall&Casadesus-Masanell,2010), research capability (Laursen & Salter, 2006), and industry membership (Grimpe & Sofka, 2009). However, recent studies reveal that companies that have successfully capitalized on integrating external sources of knowledge intotheirinnovationprocessesprimarilystandoutin organizational terms: They are characterized by organizational flexibility and a willingnesstorestructuretheirexistingbusinessmodelstoaccommodate open innovation strategies (Chesbrough & Schwartz, 2007; Hienerth, Keinz, & Lettl, 2011; Keinz, Hienerth, & Lettl, 2012; van der Meer, 2007). It was defined business models as the content, structure, and governance of transactions inside the company and between the company and its external partners in support of the company's creation, delivery and capture of value (Santos, Spector, & van der Heyden, 2009; Zott & Amit, 2008, 2010). As business modelsreflectthestrategicchoicesofthecompany(Magretta,2002; Zott & Amit, 2008), the choice of open innovation requires that the company defines those ways to create, deliver and capture value inconjunctionwithexternalpartnersthatareconsistentwithopen innovation (Hienerth et al., 2011; Vanhaverbeke, 2006). In support of thisoverallproposition,empiricalevidencestronglysuggeststhat organizational design, practices and capabilities need to be aligned with open innovation strategies, so as to positively influence the sourcingof knowledgefromexternalpartiesanditssubsequentexploitation for innovation (Foss, Laursen, & Pedersen, 2011; Jansen, Van den Bosch, & Volberda, 2005; Keinz et al., 2012; Salge et al., 2012). These findings indicate that companies wishing to engage in open innovation must (at least partly) re-organize their business models as to accommodate their open innovation strategies and to subsequently enhance innovative performance(Saebi & Foss, 2015).

2.6. SCKM and Open Innovation Flows

Researches show that both open innovation and knowledge management capability have a positive influence on dual innovation (sun et al.,2020).“The methodorganizations manage theinnovation process throughout the supply chain is addressed in various forms in the literature., five key innovation strategies were found: (a) partnerships for specific purposes; (b) projects coordinated by another organization; (c) the integration of both – new products and processes development between actors in the supply chain; (d) the strategic alignment between actors in the supply chain and (e) open innovation strategy”(Zimmermann, DF Ferreira, & Carrizo Moreira, 2016).The strategy of integration for the development of new products and processes, the strategic alignment and the open innovation strategy lead to havesustainable results for businesses. According literature review, it was found there is a shortage studies on the effect of supply chains on the different types of innovation and the different phases of the innovation process(Zimmermann et al., 2016). open innovation flows are built on cooperationthrough a network of partners concluded from suppliers of raw materials, equipment, research institutes to consumers and customers that create value for the end consumer(Bigliardi, Bottani, & Galati, 2010; West & Lakhani, 2008). however it may also require the firm to collaborate with other actors in order to implement the technology(Jensen, Johnson, Lorenz, Lundvall, & Lundvall, 2007). It is found that there is a collaboration between external technology and knowledge sources(Love, Roper, & Bryson, 2011). and this cooperation has affected positively on innovation performance(Grimpe & Kaiser, 2010; Leiponen & Helfat, 2010).it is necessary to say that managing coordinated innovation by network partners requires specific management attention(Ocasio, 1997). As what Christensen in 2006 said(Christensen, 2006), “open innovation can be considered an organizational innovation”. To reach this purpose, companiesshould implement

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main processes and develop knowledge management capabilities(Lichtenthaler, 2009).”Open innovation has the very important rolein knowledge based organizations performance that when,comes beside the importance of supply chain management can play an enhanced effect in today competitive world. The systematic literature review exploring the relationship between supply chains and the innovation process demonstrated the complexity of the topic, its timeliness, and its embracing character. The co-operation with external actors becomes relevant to innovation process and, as the supply chain is an important context for relationships among actors, its relationship to innovation showed up as an important object of study. The relationships between partners of the supply chain are potentially facilitators of the innovation process concluded open innovation too. According to literaturethese main facilitators are: building trust relationships, the frequency of information sharing, shared decision-making, the integration of information systems, and compatibility of technologies used by partners, cooperative behavior of all actors and the efficient management of supply chains, including their resilience”(Zimmermann et al., 2016).These facilitators as KPIs of SCKM in open innovation flows. On the other hand these KPIs can increase open innovation systems performance and it could be happen by supply chain knowledge management.at the end of our papers review, it wasshown a model as an example of open innovation flows through supply chain knowledge management in figure 3(Bigliardi et al., 2010; West & Lakhani, 2008). this model has summarized the supply chain in three parts as manufacturer, supplier and customer to avoid complexity of concept. surely there is a big chance for future studies to design more complicated models for SCKM in open innovation strategies to show more sides of other supply chain actors.

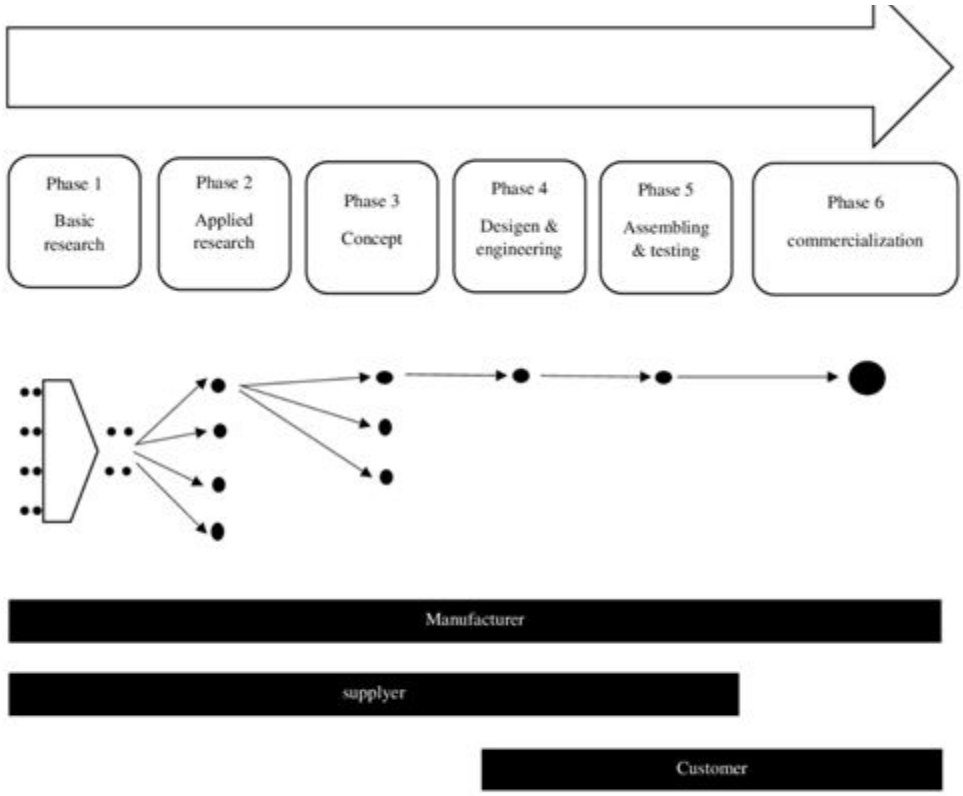

Figure 3: The innovation process of Manufacturer and the development of each actor of the supply chain *(Bigliardi et al., 2010; West & Lakhani, 2008)*

3. Discussion

It was found in this literature review, the classic definition of supply chain has been changed during the years and today there is a promoted concept of supply chain management that not limited to the tangible items like goods and services. New Supply chain management definition contains an intangible items like knowledge, ideas and information too. This new look to SCM has leaded to arise the kind of SCM that is called supply chain knowledge

Figure 3: The innovation process of Manufacturer and the development of each actor of the supply chain *(Bigliardi et al., 2010; West & Lakhani, 2008)*

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management. SCKM as other classic SCM has some important KPIs that was noted in this review paper.at the end there is a short look on SCKM in open innovation flows and tried to extend this concept by searching more in previous literatures .of course there was lack of enough papers to fortify our review and surely there is an opportunity to fulfill this gap in near future studies.

4. Implication

It wasnoted in this literature survey, the concept of supply chain knowledge management is a young field that could be extended by researchers and students. Especially this term has more novelty when has developed to open innovation flows. Theoretically has seen a gap or shortage of literature about this subject that can fulfill by these kind of reviews and finallythe studies like this could have practical implication to know more about supply chain knowledge management in open innovation flows while leads to new modeling of related supply chains.

5. Limitation

The most important limitation of this paper could be that there is a shortage of related papers instead of all our attepmts.it could be happened because of novelty of this concept that is a new born term in compare with classic supply chain. Especially the combination of supply chain knowledge management and open innovation flows will shape a very new field.

6. Future Study Suggestions

Trying to fulfill the lack of literature in this field can be a good suggestion for researchers in their future studies.Designing new models for supply chain knowledge management in open innovation systems and adopting proper KPIs for them will be suggested.

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