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Paradigm Shift from Lean Towards Agile Supply Chain Management for Business Performance Enhancement in Indian Manufacturing Industry

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Abstract - Post pandemic, the markets have become highly turbulent and volatile due to uncertainty and global economic and competitive pressures. The prolonged and sluggish logistics channels have become unsustainable, thus warranting inevitable changes in the structure and management of supply chains. This research work highlights key vital factors required for survival in these circumstances by providing insights into vital factors required for imbibing agility in an organization. The basic purpose of this paper is to comprehensively review the literature on agile supply chain management (ASCM), keeping in view the objective of a thematic examination of the literature to elucidate the primary factors of ASCM.This work is a novel effort to use various descriptive analysis techniques using pivot charts and tables to analyse the key factors regarding the application of agile ASCM in manufacturing industries.

Keywords – Agile Supply Chain Management, Uncertainty in the environment, Operations management, Manufacturing industries, India.

1. INTRODUCTION

The coronavirus disease 2019 (COVID-19), first started in China towards the end of 2019 and has spread worldwide, thus causing current pandemic condition (Statista, 2020). This pandemic situation has caused grave economic and social disturbance worldwide leading to a major global downturn (Wheelock, 2020). Since the start of its major outburst in early months of 2020, the unexpected demand for certain products led to complications in handling Supply Chain Management (SCM) for all industries due to limitations of the lockdown (Statista, 2020). As this pandemic was of unprecedented dimension, there were no particular comparisons and past research in this field. SCM is a network of various representatives responsible for accomplishing various critical functions and synchronizing key conclusions with further pertinent representatives. Functional representatives and information representatives are two types of representatives who control activities in the supply chain and support other representatives by giving the relevant information respectively.

2. SUPPLY CHAIN MANAGEMENT (SCM) AND LOGISTICS

Lambert et al. (1998) stated that various business processes need to be integrated i.e., from end-user to supplier. This includes raw material, finished products, and services by optimally using information available from various sources thus adding value for end-users. Earlier, the products were simple (Fulkerson, 1997; Cao and Zhang, 2011), therefore, companies manufactured them independently (Kumar, 2004; Burgess et al., 2006). However, over the period of time with the advent of globalization, the majority of the components were started being outsourced. Hence the suppliers became key stakeholders in the supply chain process (Chen and Paulraj, 2004; Gripsrud et al., 2006). The schematic diagram on SCM given by Fox et al. (1993) highlights the overall view of the supply chain in the organization (Figure 1). Li (2014) reveals that in the early 1960s, an MIT professor, Jay Forrester, worked on various parameters related to suppliers with customers and realized that the physical separation of the inventories from the customers adversely affected the supply chain leading to excess inventory or orders not completed. By adjusting to the flexibility to cater to market requirements, the supply chain can effectively provide products and services. The business competition globally is organization driven, and key role is played by their supply chains (Kuei et al., 2001; Li et al. 2005).

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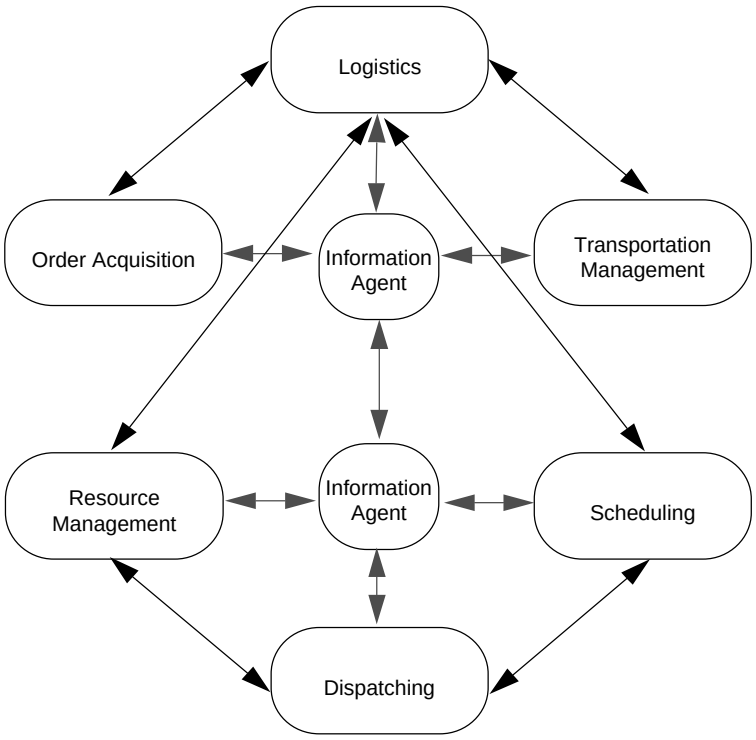

Figure 1 Basic SCM Model (Fox et al. 1993)

3 LEAN SUPPLY CHAIN MANAGEMENT (LSCM) AND TRANSFORMATION FROM LEAN TOWARDS AGILE SCM

Lean production acquired a key role by 1994-95 and was used as an overriding strategy by the organizations (Karlsson and Ahlstrom, 1996). Womack et al. (1990) have claimed that the philosophies of lean production can facilitate organizations for enhancing performance proportionately.In the current scenario of post-pandemic, SCM strategy for manufacturing industries is predominantly based on external factors, and accordingly, they had to decide between lean and agile (Abdollahi, 2015; Abdallah and Nabass, 2018). Going lean has the inherent disadvantage of lost opportunities as orders could not be materialized due to a shortage of supplies. However, it is more cost-effective than going agile as the later requires major digital transformation (Shashi et al., 2020). With the right digital transformation, an enterprise can quickly move from lean towards agile and vice versa at short notice. The pandemic has made everyone realize that their SCM needs to be robust to cater to unforeseen eventualities (Koh et al., 2007; Shashi et al., 2020). The major steps for the supply chain network to be more resilient and agile are:

- Data foundation
- Data analysis within the supply chain by creating a digital network
- Effective Supplier relationship
- Change management
- Dynamically modifying supply chain as per market requirement.

There are lots of similarities between the lean and agile SCM. If the entire process is appropriately planned and monitored, lean as well as agile systems can simultaneously exist in the organization, and the transition from Lean to Agile is also easy (Aitken, 2000). ASCM has achieved good attention among academicians in the last few years, and significant research in this field has added to the overall knowledge base. However, the major focus has been on case studies and direct surveys (Rahiminezhad and Helmi, 2016). Very little work has been reported on theory verification and transition from LSCM to ASCM. Table 1 describes the detailed review of literature on ASCM depicting the analysis methods and critical factors considered in various studies. 460 research papers published in major peer reviewed journals over a period of last twenty years have been surveyed, and vital few (55 research papers) were then critically reviewed in order to identify the factors critical for successful agile organizations in managing their supply chains and provide insights about vital factors required for the agility in an

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organization. The articles were shortlisted from peer-reviewed journals only, as they follow very stringent review process (Karuppusami and Gandhinathan, 2006). As an initial step, all important factors were recorded from the literature directly. Subsequently, grouping of these factors was done depending on their context, giving new name to each group using "descriptive approach". For instance, all factors depicting Organizational Culture i.e., uncertainty, collaborative relationships, responsiveness to Organizational Culture-related issues responsiveness to external change, competency, flexibility, enterprise integration, decentralized decision making, multi-venturing capabilities, inter-organization coordination, adaptability and information visibility were grouped together.

TABLE I

Table I Analysis methods and Critical factors in various ASCM studies

Authors	Country	Industry	Analysis method	Journal	Database	Factors
Sharp et al. (1999)	UK	Multiple	Descriptive analysis	International Journal of Production Economics	Elsevier	Manufacturing agility, Customer related issues, Organization Responsiveness
Meade and Sarkis (1999)	USA	Multiple	Descriptive analysis	International Journal of Production Research	Taylor & Francis	Customer related issues, IT and its elements, Human Resource Development (HRD) issues, Organization Responsiveness
Sharifi and Zhang (1999)	UK	Multiple	Comparative analysis	International Journal of Production Economics	Elsevier	Strategic Supplier Alignment, Customer related issues
Breu et al. (2002)	UK	Multiple	Principal component and correlation	Journal of Information Technology	Taylor & Francis	Administrative issues, IT and its elements
Ren et al. (2003)	USA	Multiple	Artificial Neural Network	Integrated Manufacturing systems	Emerald	Resource optimization, Manufacturing agility, Administrative issues, Customer related issues
Guisinger and Ghorashi (2004)	USA	Chemical industry	Comparative analysis	International Journal of Operations and Production Management	Emerald	HRD issues, Manufacturing agility
Devadasan et al. (2005)	India	Pump Industry	Taguchi methods	Journal of Manufacturing Technology Management	Emerald	Resource optimization, Flexible/hybrid engineering
Dowlatshahi and Cao (2006)	USA	Multiple	Structural Equation Modelling	European Journal of Operational Research	Elsevier	Collaborative relationships, Administrative issues, Flexibility, Logistic integration

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Lin et al. (2006)	Taiwan	Casting	Descriptive analysis	International Journal of Production Economics	Elsevier	Resource optimization, Process integration, Administrative issues, IT and its elements, Flexibility
Vazquez-Bustelo et al. (2007)	Spain	Multiple	Exploratory factor analysis	International Journal of Operations and Production Management	Emerald	Flexibility Responsiveness.IT and its elements
Ramesh and Devadasan (2007)	India	Pump Industry	Descriptive analysis	International Journal of Mass Customization	Inderscience	Customer related issues, Strategic Supplier Alignment
Eshlaghy et al. (2010)	Iran	Multiple	Exploratory factor analysis	International Journal of Production Research	Taylor & Francis	IT and its elements, Knowledge optimisation
Zhang (2011)	UK	Multiple	Content and Cross-case analysis	International Journal of Production Economics	Elsevier	Administrative issues, Flexibility
Sreenivasa et al. (2012)	India	Pneumatic Products	Descriptive analysis	International Journal of Services and Operations Management	Inderscience	IT and its elements
AL-Tahat and Batainesh (2012)	Jordan	Multiple	Structural Equation Modelling	Mathematical Problems in Engineering	Hindawi Publishing Corporation	Flexibility, Operational performance
Mishra et al. (2011)	India	Automobile	Fuzzy logic	International Journal of Logistics Systems and Management	Inderscience	Flexibility, Customer related issues, Administrative issues
Aravindraj and Vinodh (2014)	India	Relays Manufacturing Industry	Fuzzy logic	Journal of Engineering, Design and Technology	Emerald	Customer related issues, IT and its elements, Knowledge optimisation
Samantra et al. (2015)	India	Automobile	Fuzzy logic	International Journal of Industrial and Systems Engineering	Inderscience	IT and its elements, Organization Responsiveness, Cost efficiency
Dubey and Gunasekaran (2015)	India	Multiple	Confirmatory factor analysis	International Journal of Advanced Manufacturing Technology	Springer	Administrative issues, Customer related issues
Routroy et al. (2015)	India	Boiler manufacturing industry	Fuzzy logic	Measuring Business Excellence	Emerald	Cost management, IT and its elements

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Dev and Kumar (2016)	India	Equipment manufacturing industry	Analytical Hierarchy Process (AHP)	Chinese Journal of Mechanical Engineering	Springer	HRD issues, Business process reengineering
Leite and Braz (2016)	Portugal	Multiple	Content analysis	Journal of Manufacturing Technology Management	Emerald	Flexible/hybrid engineering
Sindhwani and Malhotra (2016)	India	Multiple	Descriptive analysis	Process Management and Benchmarking	Inderscience	IT and its elements, Network efficiency
Kumar et al. (2017)	India	Automobile	Interpretive structural modelling	International Journal of System Assurance Engineering and Management	Springer	HRD issues, Cost efficiency
Sindhwani and Malhotra (2017)	India	Multiple	Total interpretive structural modelling (TISM) and MICMAC analysis	Benchmarking: An International Journal	Emerald	Flexibility, IT and its elements
Mittal et al. (2017)	India	Multiple	MOORA method and VIKOR analysis	Procedia CIRP	Science Direct	IT and its elements, Knowledge optimisation
Patel et al. (2017)	India	Multiple	Fuzzy logic	Journal of Manufacturing Technology Management	Emerald	Quality management, Manufacturing agility, IT and its elements, Strategic Supplier Alignment, Manufacturing management
Goswami and Kumar (2018)	India	Automobile	Structural Equation Modelling	Measuring Business Excellence	Emerald	Manufacturing management, Flexible/hybrid engineering, Product complexity
Khatri et al. (2018)	India	Multiple	Correlation analysis, regression analysis, principal component analysis	International Journal of Business Information Systems	Inderscience	Collaborative relationships. Administrative issues. Flexibility
Nejatian et al. (2018)	Iran	Food industry	Fuzzy logic	Benchmarking: An International Journal	Emerald	IT and its elements, Organization Responsiveness
Christopher (2000)	UK	Multiple	Descriptive analysis	Industrial Marketing Management	Elsevier	IT and its elements, Network efficiency

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Yusuf et al. (1999)	UK	Manufacturing Industry	Descriptive analysis	International Journal of Production Economics	Elsevier	Organization Responsiveness, Manufacturing management
Agarwal et al. (2006)	India	Multiple	Descriptive analysis	European Journal of Operational Research	Elsevier	HRD issues
Braunscheidel and Suresh (2009)	USA	Multiple	Structural Equation Modelling	Journal of Operations Management	Elsevier	HRD issues, Flexibility
Overby et al. (2006)	USA	IT	Exploratory factor analysis	European Journal of Information Systems	Springer	Process integration, IT and its elements
Swafford et al. (2006)	USA	Multiple	empirical study/modelling	International Journal of Production Economics	Elsevier	Customer related issues, Organization Responsiveness
van Hoek, Harrison, and Christopher (2001)	UK	IT	Descriptive analysis	International Journal of Operations and Production Management	Emerald	Quality management, HRD issues, Flexibility, Cost efficiency
Power, Sohal, and Rahman (2001)	Australia	Manufacturing Industry	empirical study/modelling	International Journal of Physical Distribution & Logistics Management	Emerald	Market sensitivity, Administrative issues, Flexibility, Cost efficiency, Operational performance
Swafford, Ghosh, and Murthy (2008)	USA	IT	Descriptive analysis	International Journal of Production Economics	Elsevier	Business process reengineering, Organization Responsiveness, IT and its elements
Mason-Jones and Towill (1997)	UK	Fashion Industry	Simulation	International Journal of Production Economics	Elsevier	Flexible/hybrid engineering
Inman, Sale, Jr, and Whitten (2011)	USA	Manufacturing Industry	Structural Equation Modelling	Journal of Operations Management	Elsevier	Strategic Supplier Alignment, Customer related issues
Tsourveloudis and Valavanis (2002)	Greece	Multiple	Correlation analysis, regression analysis, principal component analysis	Journal of Intelligent and Robotic Systems	Springer	Customer related issues, HRD issues

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Elnagar et al. (2018)	UK	Manufacturing Industry	Triangulation research approach	Journal of Open Innovation: Technology, Market, and Complexity	MDPI	Flexibility, Organization Responsiveness, Market sensitivity
De Vass et al. (2021)	Australia	IT	IOT	Australian Journal of Information Systems	Springer	Process integration, IT and its elements
Geng et al. (2020)	China	Marine Industry	QFD, Fuzzy and Evaluation Laboratory (DEMATEL)	Journal of Marine Science and Engineering	MDPI	Knowledge optimisation issues, Flexibility
Kumar et al. (2017),	India	Multiple	Descriptive analysis	Journal of Management Information and Decision Sciences	Elsevier	Supply chain optimisation, Flexible/hybrid engineering
Sahu, et.al, (2016)	India	Multiple	Analytical Hierarchy Process (AHP)	International Journal of Decision Support System Technology	Emerald	Organization Responsiveness, Flexibility
Masson et al. (2007)	UK	Fashion Industry	Descriptive analysis	International Journal of Logistics Management	Emerald	IT and its elements
Stefanelli et al. (2019)	Italy	Multiple	Descriptive analysis	Journal of Supply Chain Management	Emerald	Supply chain optimisation, Customer related issues, Organization Responsiveness
Lotfi and Saghiri (2018)	UK	Multiple	Structural Equation Modelling	Journal of Manufacturing Technology Management,	Emerald	Customer related issues
Moradi et al. (2020)	Iran	Multiple	Integrated FQFD approach	International Journal of Lean Six Sigma,	Emerald	IT and its elements, Administrative issues
Tse et al. (2016)	UK	Electronics	Structural Equation Modelling	Journal of Supply Chain Management	Emerald	Supply chain optimisation, IT and its elements, Organization Responsiveness
Mwangola (2018)	USA	Multiple	Descriptive analysis	American Journal of Management	Emerald	Organization Responsiveness
Abdelilah et al. (2018)	Morocco	Multiple	Descriptive analysis	Journal of Manufacturing Technology Management	Emerald	Flexibility, Customer related issues, IT and its elements issues
Kannan et al. (2025)	India	Multiple	Descriptive Analysis	IOSR Journal of Business and Management	Emerald	Operational Efficiency, Market Responsiveness

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Riska and Munjiati Munawaroh(2024)	Indonasia	Multiple	Descriptive Analysis	(International Research Journal of Multidisciplinary Scope (IRJMS)	Emerald	Supply Chain Strategy Trends,Lean, Agile, Leagile

The research publications critically scrutinized for the study have been depicted in Figure 2.

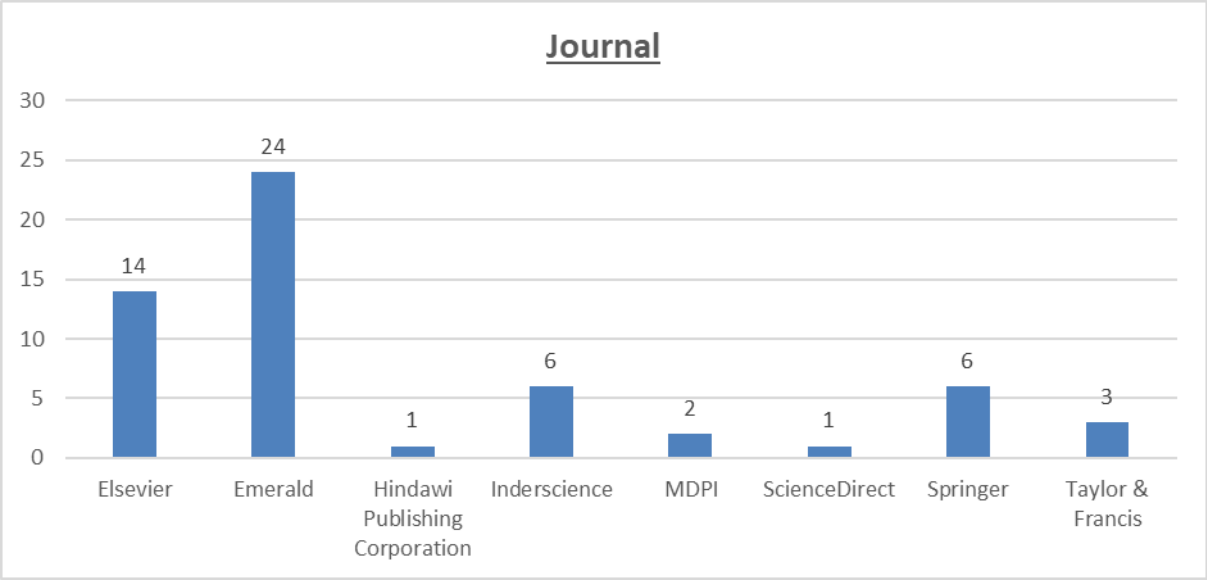

Figure 2 Research publications critically scrutinized for the study

There are various analysis method used by the researchers, however most of them are either descriptive analysis or simulation technique. The details of the analysis done in these papers is given in Figure 3.

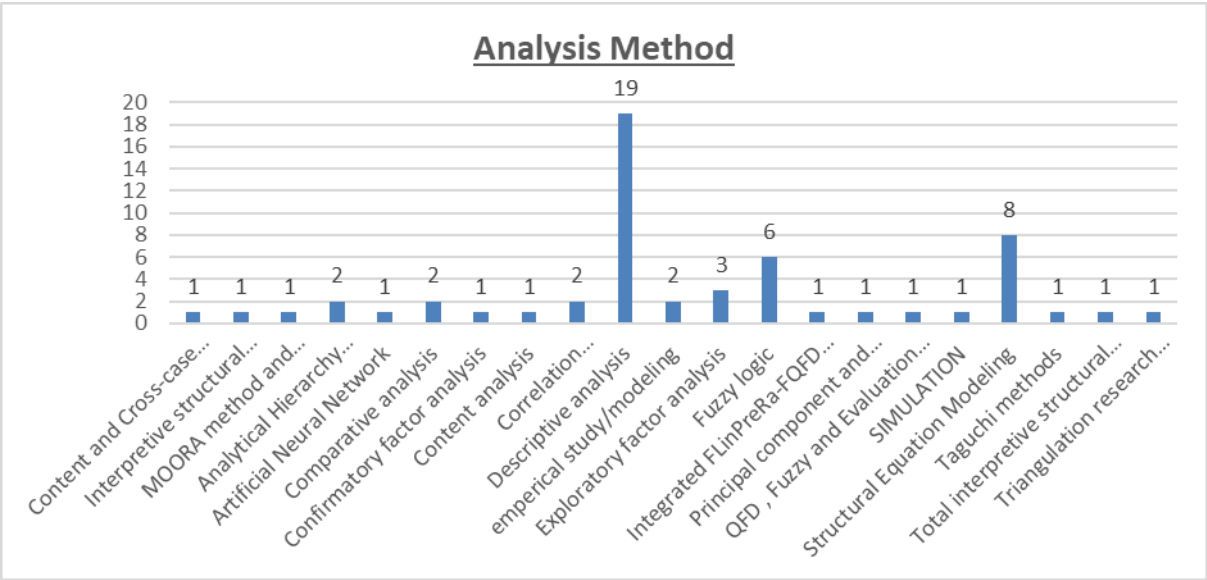

Figure 3 Analysis method used by the researchers in ASCM

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The reseach papers were analysed pan world which have been published in english language only. As the supply chain modalities are affected by the region, hence maximum papers are from India. However, as developed nations have already been working on agility of the supply chain, enough importance was given to the research which has been done in USA and UK. Figure 4 shows the region wise description of counties regarding ASCM applications.

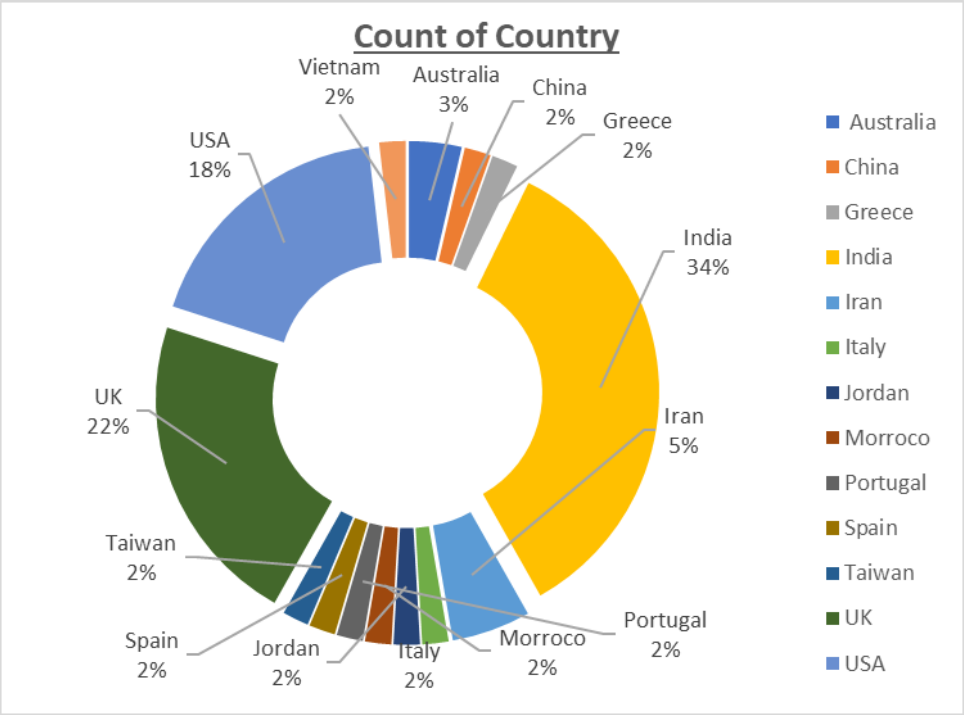

Figure 4 shows the region wise description of counties regarding ASCM applications

The research papers for analysis were selected in such a manner that all verticles of the industry are comprehensivily coverd which include automobile, manufacturing, food and also generic papers covering multiple industries. Figure 5 reveals the implementation of ASCM initiatives in various industrial domains.

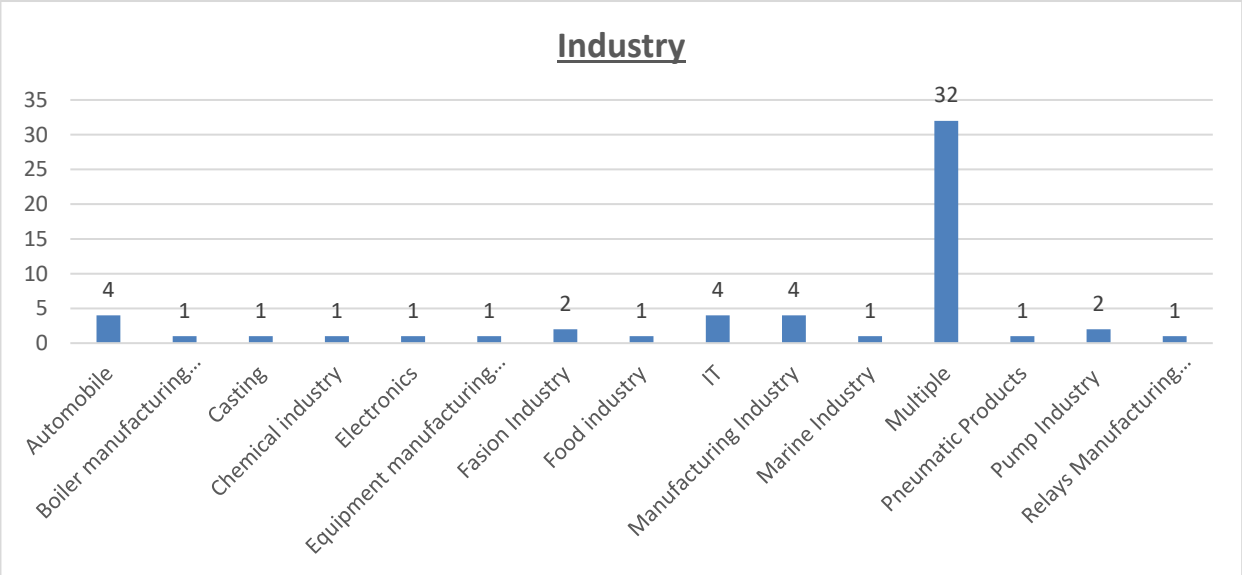

Figure 5 Sector wise description of ASCM implementation

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4. DISCUSSION AND CONCLUSIONS

Though the present research extensively covers the past literature, however, there is need to carry out qualitative analysis to empirically examine the validity and reliability of key vital factors which are necessary prerequisites for the desired transition. However, the KVFs which will be extracted in the study are not generic as they are influenced by the terrestrial factors and type of business and economic conditions. Second, the factors drawn from this work will not be universal and may vary depending on the nature of business, geographical areas and many others. There are various industries that have transitioned from lean to agile SCM, this transition is limited based on overall industry requirements. The further analysis of various KVFs will differentiate between the individual requirements of these industries and based on that their overall level of the transition from lean to agile SCM.

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