

Knowledge Management Practices and Organisational Performance in Manufacturing Companies

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Abstract:

Knowledge and knowledge management are considered as one of the important business salvation tools to combat challenges and to enhance competitiveness in the globalised dynamic business scenario. This paper aims to segment the Indian manufacturing organisations based on their extent of KM adoption and their performance and in turn ascertain a relationship between them. A conceptual framework encompassing the KM and performance was developed based on the literature studies. A quantitative survey based research was carried out using a structured validated questionnaire. The data are collected from top and middle level managers of manufacturing companies in India through convenience sampling. 251 responses were obtained. The respondents were clustered based on their KM adoption and the performance using k-mean clustering. Then the association between the extent of KM adoption and the performance is analysed using correspondence analysis. The results established a direct and significant association between the extent of KM adoption and their performance in terms of innovation, operational and organisational performance. The study is carried out in manufacturing companies in south India hence generalising the findings should be done with care.

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I. INTRODUCTION

A developing economy predominantly depends on its manufacturing sector especially in developing economies. India is growing significantly in manufacturing sector and policies such as “Make in India” attracts large manufacturing companies to enter into Indian market and hence increases foreign investments. India is striving to become 5th largest manufacturing economy by 2020 [1] Indian manufacturing sector with 53 lakhs manufacturing units [2] contributing over 15% to GDP is positioned favourably in the world in view of its skilled manpower, established raw material and supply base and low cost production. Today, manufacturing is a

strategic concern and has become knowledge intensive and paradigm of manufacturing has changed to managing knowledge assets.

Major challenge to manufacturing is from heightened competition in the globalised business world. The firms are striving to satisfy large number of customers at the reduced time. Customer needs and preferences are changing and manufacturing firms are under pressure to deliver more customised, specialised products of the highest quality at the lowest cost. Goods are manufactured in stages at different locations and at different times and strategies such as outsourcing and off shoring are adopted. Quality has become the number one competitive priority. More flexible production

systems with lean principles are needed to eliminate wastage, to reduce wait times and down times and achieve highest customer value [3]. Indian manufacturing sector is no exception. In addition to the above said challenges, it is beleaguered by several other challenges. Labour productivity in India is the least with 3.4% [4] and the percentage of innovative firms is only 2.3% in SMEs and 7.8% in large firms compared to that of the peer nations. Though India performs better in Global Innovation Index with 52nd position in 2019, the performance of India in global competitiveness is a matter of seriousness. India has slipped 10 places to 68th position in 2019 [5]. Manufacturing organisations sail through heavy competition with a diverse innovative strategies and KM is acclaimed as a tool for achieving competitiveness and innovation [6]. Extant literature prescribes KM as a remedy and a potential strategic tool to combat these challenges.

This study primarily focuses on investigating the present contours of KM adoption by the manufacturing firms in India and its impact on the performance of organizations in terms of innovation, operational performance and organizational performance. Such studies with a specific focus on manufacturing companies are literally unknown in the Indian scenario. Segmenting the organizations based on their extent of KM adoption and their performance and ascertaining their association will enable the practicing managers and the policy makers to understand the significance of KM and enable them to formulate suitable strategies.

The study is described in 5 sections with the forthcoming section presenting a detailed literature review. Section 3 describes the research methodology followed by data analysis and the results in section 4 and section 5 provides the interpretation of the results.

II. REVIEW OF LITERATURE

Knowledge represents one of the fundamental constituent of any organisation. By incorporating knowledge into people's capabilities or embedded

into technological and structural capital, business growth is ascertained [7]. Knowledge is unique because it is intangible, boundary less and dynamic. Traditional ways of managing, monitoring and controlling of knowledge is not possible because of its distinctive characteristics. Knowledge is defined based on the way it is perceived and used:

- Knowledge is considered as an organisational resource [8],[9].
- Knowledge is a complex system involving insights, intuitions and experiences [10],[11],[12].
- The most common paradigm of knowledge is the knowledge hierarchy [13],[11].

Similarly, literature is swarmed with many definitions of KM. This study considered knowledge as the process and is an outcome of information processing. Successful implementation of KM is reported to have produced remarkable results by providing competitive advantage through enhancing innovativeness of organisations. KM is the basis of all the organisations' capabilities to innovate and to achieve business performances. Successful KM practices enable the organisations to seize the opportunities quickly and enhance the ability to solve problems [14]. Extant literature provides substantial evidences to prove that knowledge management indeed enhances competitiveness and innovativeness. Various measures to analyse the effectiveness of KM are developed. Anantatmula and Kanungo [15] proposed a list of KM outcomes from literature, in monetary and non-monetary parameters..

Non monetary parameters include collaboration, communication, skills, productivity, and decision making and financial measures include market share, profits, and return on investment. Similarly, Estacio [16], reported that KM enables effective utilisation of right knowledge by the relevant people for explicit and implicit benefits such as enhanced team coordination, inter personal communication, financial benefits, productivity etc.

Zack et al [17] reported a profound effect of KM, in specific, knowledge creation and knowledge sharing on the performance of organisations. The performance was measured in terms of innovation, customer satisfaction and retention, cost of operations and profitability.

Knowledge management is crucial for innovation and productivity irrespective of the size of the firms and R & D efforts, KM fosters innovation and labour productivity [18]. Lee and Choi [19] reported that KM processes enhance creativity and hence the overall performance with respect to success, market share, fast growth, profitability and innovation.

In the dynamic business scenario, the key to success is innovation and creativity for sustainable growth. An organization must be aware of those factors that hampers innovation and take precautionary measures to tackle the challenges and knowledge management facilitate such strategies. [20]. Several studies corroborated a significant impact of KM on innovation.

An empirical study conducted in Japanese R & D firms reported that managerial influences played a strong role in exploiting knowledge and turning it to create new knowledge which enhances innovation [21]. Donate and Guadamillas [22] analysed the relationship between knowledge exploitation, knowledge exploration processes and innovation in Spanish manufacturing companies and reported that KM processes significantly impact innovation.

A similar study conducted in German firms confirmed that knowledge acquisition and knowledge creation processes enhanced innovation performance [23]. Li He [24] validated the impact of KM on innovation through a study involving Chinese firms. Learning, which is a component of knowledge management, affects innovation positively in Turkish SMEs [25]. Ling et al,[26] conducted an empirical study in Malaysian manufacturing companies revealed that knowledge acquisition effectiveness had a significant influence

on technological innovation of products and processes. In a country wide survey conducted in France by SESSI, CIS3 survey, comprising manufacturing companies confirmed that extensive innovation of firms is unequivocally related to their KM policies.

Thus it is proved theoretically and empirically that knowledge management is an efficient driver of organisational performance. In this paper, performance is studies under three divisions, viz. Innovation, operational performance and organisational performance.

Knowledge Management studies in India

Indian firms are striving to make a mark in the global competitive scenario by adopting KM. IT and ITES sector is the most successful KM adopters. Three Indian firms received the most precious Global MAKE awards, TATA group, Infosys technologies, WIPRO limited since 2009. The awards are conferred on the enterprises which are knowledge driven in all their activities.

In India, large manufacturing companies, IT and ITES sectors adopt KM and achieve considerable benefits. In manufacturing sector, the awareness and adoption of KM is still at its infancy. But, SMEs also practice KM at all levels of management but not formally. Structured and formal adoption of KM in SMEs is unknown in Indian SMEs [17].

A survey on KM was conducted where 17 respondents from fortune 100 companies from India whose turnover exceeded Rs. 5000 million participated [28]. The objective of the study was to identify the extent to which organisations are aware about KM and to investigate the scope of effective implementation of KM strategy in the workplace of these organisations. The study reported that the firms perceived KM to be instrumental in achieving benefits in long term, such as revenue growth, innovation etc. and also in short term such as cost reduction and improving marketing strategies. The

study also reported few impediments to KM such as lack of integration of knowledge and its use due to lack of communication, ignorance about its benefits and absence of strategic level KM adoption.

Singh.M.D, et al, [29] investigated KM adoption in diverse Indian manufacturing industries through an empirical survey including the reasons for KM adoption, challenges in its implementation and perceived benefits. Chawla and Doshi (2010a) reported that IT and ITES are better in adopting KM compared to power sector and manufacturing sector. Through a similar study in public and private sector organisations, authors reported that private sector organisations perform better from KM perspective [30].

Joshi et al, [31] conducted an exploratory study among KM practitioners in India comprising services (65%) . The KM practitioners were clustered into three groups as Active, Partly active and passive KM practitioners. The results confirm the previous studies and proved that those firms with active KM showed higher organisational performance.

Extant literature revealed that segmenting the respondent firms with a specific focus on manufacturing companies on the basis of their extent of KM adoption and their performance and ascertaining the association between them is scarcely known, particularly in the Indian context. The following objectives are formulated to address this research gap.

III. RESEARCH FRAMEWORK

A. Objectives of the study

1. To segregate the sample respondents based on the extent of adoption of KM practices
2. To cluster the sample respondents based on their performance in terms of innovation, operational performance and organisational performance
3. To determine the association between the segments based on the adoption of KM practices

and their performance in terms of innovation, operational and organisational performance.

A research framework is proposed based analysis of the earlier studies, encompassing KM processes and the performance measures identified for the study and is presented in Fig. 1.

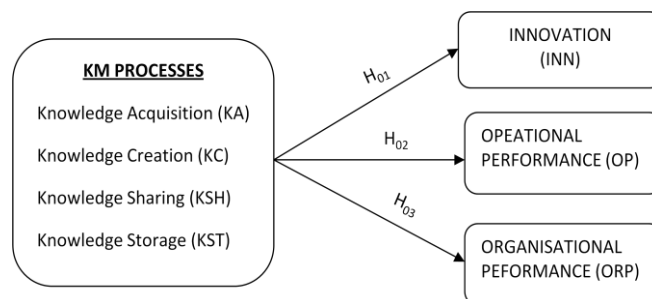


Fig. 1. Research Framework

The framework has four KM constructs viz, knowledge acquisition (KA), knowledge Creation (KC), knowledge Sharing (KSH) and knowledge storage (KST). KM influences the performance of the organisations in terms of innovation (INN), operational performance (OP) and organisational performance (ORP). The association between KM and the performance are hypothesised as given below for further analysis.

H₀₁: There is no significant association between the KM processes (KA,KC,KSH and KST) and innovation performance (INN) of the manufacturing companies.

H₀₂: There is no significant association between the KM processes (KA,KC,KSH and KST) and operational performance(OP) of the manufacturing companies.

H₀₃: There is no significant association between the KM processes (KA,KC,KSH and KST) and organisational performance (ORP) of the manufacturing companies.

Research methodology adopted, data analysis and interpretation of the outcomes are described in the next sections.

IV. RESEARCH METHODOLOGY

Research design: A comprehensive approach to the study on KM processes and the effect of KM on performance in terms of innovation, operational and organizational performance is scarce in the Indian scenario. Hence this study is exploratory in nature using descriptive research design.

Majority of manufacturing organizations in India do not have formal KM systems. But knowledge is the pivot of the organizations that continue to survive and grow. Manufacturing organisations attempt to satisfy the customer needs and continuously innovate to survive. Hence it is assumed that even though formal KM systems are not in practice, organizations would indeed have certain KM practices in place. This is the reason for exploring the awareness level of KM and the nature of practices adopted by manufacturing organizations. In addition, the study also explores the impact of KM on performance.

Based on the literature, it could be concluded that majority of manufacturing organizations in India, irrespective of their size, do not have formal KM systems. Hence the study focuses on manufacturing companies as the population for the study without any distinction based on their size though micro companies are not under the scope of the study. The scope of the study is confined to only government developed industrial estates. The sample size and its representativeness of the population are two important parameters in sampling method. Sample size is determined using pilot study and is calculated to be 243. The respondents were chosen by convenience sampling. A minimum of two to a maximum of five responses from each firm preferably from top management and from middle management are sought from the respondent firms.

Sample size : Pilot study is conducted using the validated questionnaire to estimate the sample size. Using the mean(3.52) and standard deviation(1.36) values from the pilot study, sample size is calculated to be 243 using the following formula.

$$n = \left(\frac{\sigma * 1.96}{\mu * 0.05} \right)^2$$

Data collection tools: The research instrument, questionnaire is drafted based on the literature studies extracting items for constructs relevant for the study wherever available. Few items and constructs are generated in the study. The questionnaire is then checked for its face and content validity by experts from industries and academia. Final questionnaire is then administered for data collected and data thus collected are analysed.

V. DATA ANALYSIS AND INTERPRETATION

Before the actual data analysis, reliability and validity of the parameters considered are analysed and given in Table 2. Reliability is testing the degree to which a measurement is accurate or free of errors. One of the robust reliability testing is the calculation of Cronbach's alpha and its acceptable lower limit is 0.60 [33].

Convergent validity is checked by exploratory factor analysis methods with SPSS and calculation of fit indices using LISREL. In this research the constructs are modified to suit the research setting and few are generated newly for the study.

Table - I: Measurement Properties Of The Study Constructs

CONSTRUCT VALIDITY OF THE CONSTRUCTS THROUGH FACTOR ANALYSIS						Reliability (Cronbach's alpha)
Constructs	GFI	NN FI	CFI	RMS EA	Total Variance Explained	
KA	0.99	0.94	0.98	0.07	63.59	0.659
KC	0.99	0.99	1.00	0.036	52.83	0.703
KS H	0.98	0.95	0.97	0.09	49.69	0.799
KST	0.97	0.97	0.98	0.069	50.22	0.745
INN	0.97	0.98	0.99	0.018	59.63	0.856
OP	0.98	0.98	0.99	0.067	58.25	0.827
ORP	0.96	0.97	0.98	0.082	53.377	0.812

To ensure the validity of these scales, unidimensionality of the constructs have to be statistically verified. Unidimensionality can also be assessed through confirmatory factor analysis using SEM tools. The results are summarized in Table -I. The fit indices, GFI, CFI and NNFI are all above 0.9 [34] indicating the model fit. RMSEA values below 0.09 is another measure for model fit and RMSEA values in this case are well below 0.09 except in one case, KSH where it is exactly 0.09. Exploratory factor analysis of constructs for unidimensionality was determined using SPSS 16 software. Only one component is extracted in all the cases and total variance explained are above 50% showing that 50-75% of the process is explained by the variables under each construct. The cronbach's alpha values which is used a robust measure to test the reliability are more than 0.6 confirming the internal consistency of data.

The validated data is then tested for hypotheses using cluster analysis followed by correspondence analysis.

A. Cluster Analysis And Correspondence Analysis

In order to exactly bring out the extent of association between the KM processes and the performance measures, respondents are segmented into clusters based on their extent of KM adoption using k-means clustering. The resultant clusters are named as the "high KM practitioners", "moderate KM practitioners" and "less KM practitioners" of KA, KC, KSH and KST based on the mean values of the cluster members. The clustering reliability is validated using discriminant analysis and the results are summarised in Table II. Discriminant analysis is used to give an insight into the relationship between cluster membership and the variables used to predict the membership and the reliability of the classification. The measures used to estimate the reliability are Wilk's lambda, Eigen values and canonical correlation values [35].

Table – II: Cluster Analysis of KM processes and the reliability testing of the clusters

	Cluster names	No. Of firms	Mean values	Wilk's Lambda	Eigen values	Canonical correlation	Accuracy of classification
KA	High KA	117	4.034	0.199	2.205	0.829	96%
	moderate KA	60	3.274				
	less KA	74	2.602				
KC	High KC	111	3.985	0.156	2.78	0.858	96%
	moderate KC	84	3.1625				
	less KC	56	2.1375				
KST	High KST	88	4.62	0.141	4.958	0.912	97.2%
	moderate KST	119	3.78				
	less KST	44	2.75				
KSH	High KSH	103	4.268	0.116	4.7	0.908	99.6%
	moderate KSH	87	3.376				
	less KSH	61	2.33				

Eigen value represents the robust differentiation of the groups, where larger Eigen value confirms effective differentiation [36]. Wilk's lambda

provides the proportion of unexplained total variability. Lower the Wilk's lambda, lower is the unexplained proportion. Canonical correlation values

indicate the multiple correlations between the predictors and the discriminate functions. Higher the value, higher is the correlation. Table II provides the summary of the results of discriminant analysis of KM practices.

It is observed that Wilk's lambda is less than 0.2 indicating at least 80% of the variance is explained by the clusters. Similarly, minimum 83% to a maximum of 91% correlation is explained by the canonical correlation values and Eigen values are high indicating the reliability of clustering. Similarly, organisations are grouped based on the performance measures i.e. innovation, operational performance and organisational performance. The clusters, their names, number of firms under each cluster, their reliability measures and % of accuracy of classification of the performance are given in Table -III.

It is seen that the respondents are clustered based on their level of performance and the accuracy of classification ranges from 86% to 98.5% and all the performance variables show a low wilk's lambda values (between 0.1 to 0.27) and high eigen values (1.7 to 6.78). The values confirm the reliability of clustering and hence the data was then analysed to test the hypotheses.

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VI. HYPOTHESIS TESTING

A. Association between KM and INN

Hypotheses formulated for examining the impact of KM on INN of the organisations are as follows:

H₀₁: There is no significant association between the extent of KM (KA,KC,KST and KSH) adoption in organisations and their organisational performance.

H₁₁: There is a significant association between the extent of KM (KA,KC,KST and KSH) adoption in organisations and their organisational performance.

The association between INN and the extent of KM adoption is tested through correspondence analysis and the results are given in Fig. 2.

Table – III: Summary of Cluster and Discriminant Analysis Results of KM Benefits

Constructs	Cluster names	No. Of firms in each cluster	Mean values	Wilk's Lambda	Eigen values	Canonical correlation	Accuracy of classification
INN	High INN	107	4.73	0.277	1.771	0.779	86.5%
	P & P INN	16	2.26				
	Low INN	128	3.59				
OP	Very high OP	63	4.76	0.120	5.893	0.925	96.8%
	High OP	141	3.97				
	Moderate OP	47	3.18				
ORP	Very high ORP	94	4.62	0.139	6.277	0.929	98.4%
	High ORP	114	3.87				
	Moderate ORP	43	3.02				

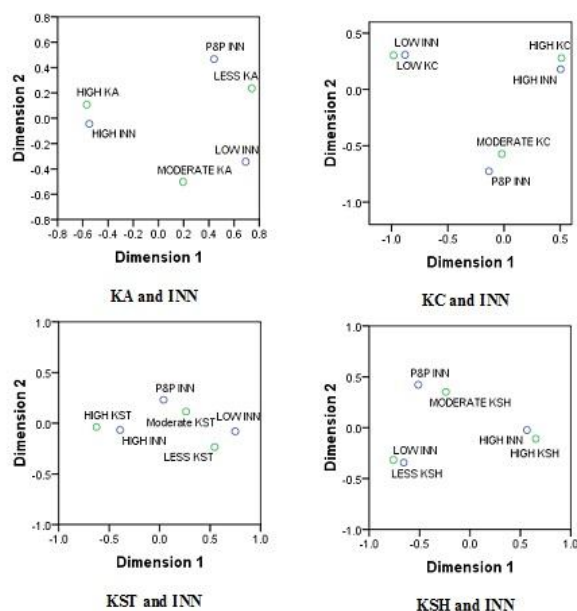


Fig. 2. Association between KM and Innovation (INN)

It is observed from Figure 2 that KA is significantly associated to the firms' innovation performance. Those firms which practice KA to a higher level, has higher innovation performance. Those firms with less KA focus on product and process innovation and not on innovations in administrative and marketing techniques.

There is a significant association between KC and innovation. It is seen that high KC leads to high innovation, low KC leads to low innovation and moderate KC results in P&P innovation.

Similarly, the correspondence analysis is done between KST and innovation and KSH and innovation indicate that there is a significant association between the extent of KST and KSH adoption and innovation.

Hence Null hypothesis H_{01} is rejected in all the cases.

B. Association between KM and OP

Hypotheses formulated for examining the impact of KM on OP of the organisations are as follows:

H_{02} : There is no significant association between the extent of KM (KA, KC, KST and KSH) adoption in organisations and their operational performance.

H_{12} : There is a significant association between the extent of KM (KA, KC, KST and KSH) adoption in organisations and their operational performance.

The association between OP and the extent of KM adoption is tested through correspondence analysis and the results are given in Fig. 3.

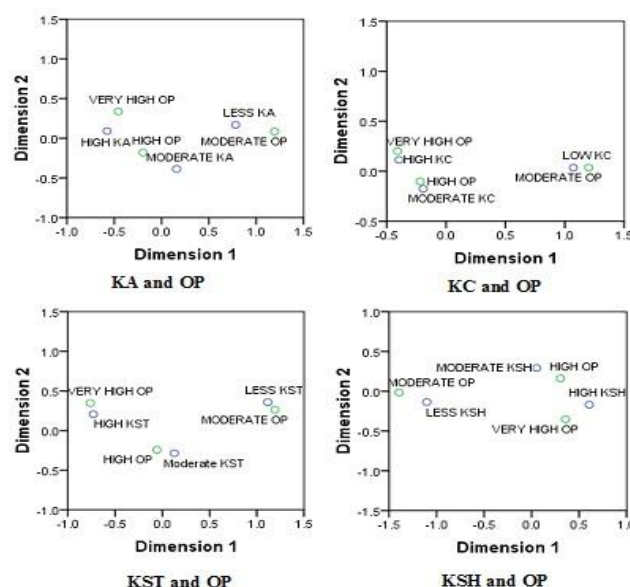


Fig. 3. Association between KM and Operational Performance (OP)

Correspondence analysis between OP and KA is done and the results are shown pictorially in Fig. 3 which shows a high association between extent of KM adoption and operational performance. High KM leads to very high operational performance. The graphs are self explanatory.

Null hypothesis H_{02} is rejected in all the cases.

C. Association between KM and ORP

Hypotheses formulated for examining the impact of KM on ORP of the organisations are as follows:

H_{03} : There is no significant association between the extent of KM (KA, KC, KST and KSH) adoption in organisations and their organisational performance.

H_{13} : There is a significant association between the extent of KM (KA, KC, KST and KSH) adoption in organisations and their organisational performance.

The association between ORP and the extent of KM adoption is tested through correspondence analysis and the results are given in Fig. 4.

The results show that there exists a significant association between the extent of KM adoption and their ORP. High KM practices lead to very high ORP, moderate KM practices lead to high ORP and less KM practices lead to moderate ORP.

Null hypothesis H_{02} is rejected.

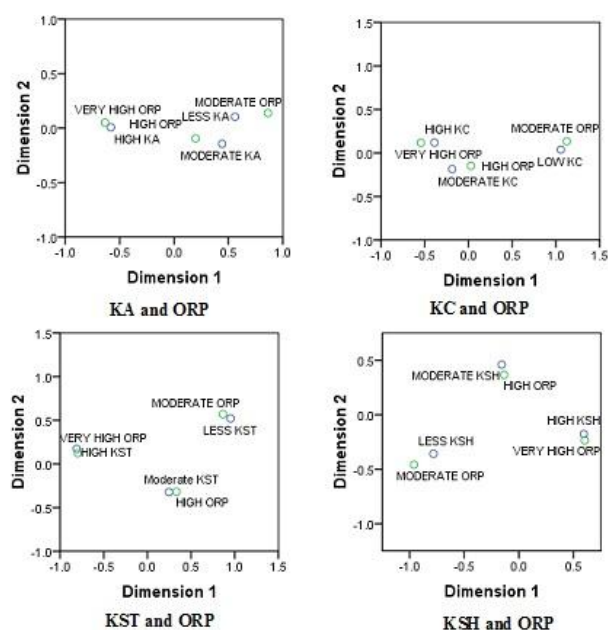


Fig. 4. Association between KM and Organisational Performance (ORP)

VII. RESULTS AND DISCUSSION

As understood by the research studies from India and abroad, knowledge management is unequivocally related to the organisational and operational performance. These results are confirmed in the case of manufacturing companies too.

SMEs are characterized by unique features which are different from that of larger enterprises. Most of the large enterprises taken part in the study are well aware of knowledge management but SMEs practice knowledge management but does not label / recognize it as knowledge management.

The analysis shows that all those firms which practice KM to a higher level show a higher innovation, high operational and organisational performance in the context of manufacturing also. The results of the study conform to the outcomes of

the previous studies in conducted different contexts (as given in Table 1). A moderate level of innovation, operational and organisational performance are realised where the KM adoption is only to a moderate level. Similarly, lesser the extent of KM adoption less is the firms' innovation and performance.

The results reinstate that effective KM leads to enhanced performance of the firms, because, these firms update themselves with the knowledge about the external business environment, competitors, markets and customers. Knowledge is acquired by participating in social activities such as conferences, training, workshops, seminars, professional networks, business meetings with customers, suppliers etc.[37],[38],[39],[40]. These activities enable the firms to be aware of the latest developments and paves way to equip the organisations to combat the competition and remain successful.

Knowledge thus acquired are stored effectively in documents are using technology, shared and applied to create new knowledge. A significant association exists between the extent of KM adoption and performance in terms of innovation, operational performance and organisational performance. Hence in all the cases, null hypotheses are rejected.

The findings throw light on the important factors to be considered, such as the need for strategic approaches for knowledge management, means to harness tacit knowledge in SMEs, conducive organisational culture, effective leadership, availability necessary infrastructure, a platform to share and transfer knowledge, mutual trust, interpersonal relationships, openness to experiments etc. for successful implementation of knowledge management.

Since SMEs work differently compared to larger organisations especially in India, an awareness to strategise knowledge management would facilitate the better understanding of knowledge management practices. Because with industry 4 revolution and technological advancements, traditional and manual operations may not help in the survival of the

manufacturing companies unless it is competitive and innovative. Embracing knowledge management tool for competitiveness would prove beneficial to manufacturing companies.

A. Future scope of research

The study considers KM processes and the performance measures as individual factors and the analysis is done by taking factor by factor separately. The results showed a significant association between KM processes and performance of the organisations. But in reality, all these factors co-exist and it is imperative to understand the impact of these factors taken together on KM processes and performance.

VIII. CONCLUSION

Knowledge is an integral part of organisations' performance. Managing knowledge formally or informally in the organisations through acquiring the relevant required and available knowledge, storing it for future use and sharing it appropriately lead to generation of new knowledge. In the Indian industrial context with specific reference to manufacturing sector, the awareness level of knowledge management is significantly high but adopting it at the strategic level is not widely seen especially in SMEs. This study attempted to explore the status of KM and segregate them into clusters based on the extent of adoption. Then the performance level of the clusters in association with the extent of KM adoption is established. It is seen that those firms with "high level of KM adoption" showed significantly higher performance in terms of innovation, operational performance and organizational performance.

It should be noted that the study is carried out exclusively in manufacturing companies in India and hence generalizing the findings to other sectors and to different contexts should be done with caution.

APPENDIX 1 TERMINOLOGIES AND ABBREVIATIONS USED

Terminologies	Definition
Innovation (INN)	Development of new product or process and its implementation [41]
Operational Performance (OP)	Ability to share knowledge at all levels of the organization, enhanced worker efficiency, productivity, flexibility, skill levels and worker involvement .
Organisational Performance (ORP)	Enhanced Revenue, profit, market reach, customer satisfaction and retention, effective decision making, increased memory so on..
Knowledge Acquisition (KA):	Identifying and assimilating required knowledge from the business environment and absorbing it for internalization [42]
Knowledge Creation (KC):	Creating new knowledge with acquired and available knowledge [42]
Knowledge Storage (KST):	Process of storing the organizational knowledge suitably for future reference [43]
Knowledge sharing (KSH):	Flow of knowledge vertically, horizontally at all levels of the organizations [44]

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