Impact of Organizational Capabilities in Managing Agility in Manufacturing System

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Abstract

The objective to study this research paper is to examine the impact of organizational capabilities on different aspects of agility of manufacturing system in Indian. In this research work survey of 119 manufacturing system have been done, the contribution of these organizations played a major role in measuring the impact of different organizational capabilities in managing agility. The correlations between organization capabilities and managing agility in manufacturing system have been measured and evaluated by implementing different statistical tools. The purpose of this survey focuses upon the important and significant role of different organizational capabilities such as technological capabilities, in-house R&D, manufacturing informatics and risk management capabilities towards managing agility in manufacturing system.

1. Introduction

Indian manufacturing industries has undergone an unexpected extent of transformation in the past years, involving changes in different technology, product customization, customer intentions, supplier association and unpredictable market situation. These factors are responsible for organizations to adapt according to market stress and competitors requirements with increasing intensity to cater both effectiveness and efficiency.

The manufacturing model has deviated from craft manufacturing to volume production and then to lean manufacturing (LM). The present era is of agile manufacturing. Agile manufacturing is also describe as new approach of manufacturing. The agility has ability to respond the changes of business environment effectively with responsiveness and convert them into opportunities (Zhang and Sharifi, 2000). Therefore, agile concept is gaining importance in various sectors but not restricted to manufacturing (Thilak et al., 2015; Fayezi et al., 2015; Liu and Liang, 2015), software (Misra and Singh, 2015; Mandal and Pal, 2015; Stettina and Hörz, 2015), healthcare (Tolf et al., 2015), etc. Yusuf and Adeleye (2002) carried out a study taking inputs from manufacturing organizations in the UK and found that the major lean attributes (i.e., cost and quality) have a limited relationship with business performance measures. They also analytically established that organizations with agility had better performance as compare with lean organizations and also concluded that lean organizations have to motivate agility level for increased competitive advantage. Sangari and Razmi (2015) found from the empirical data (from automotive manufacturing companies from Iran) that agility awareness partially facilitate the bond between business intelligence capability and agile performance of the supply

chain. Therefore, fierce competition and volatility in the current automotive market had forced automotive organization to focus both on cost and availability and had to adopt agile manufacturing (AM) to win orders in the market (Elmoselhy, 2015). Gligor et al. (2015) empirically confirmed with the increase in agility supply chain increases and the organization skill to meet the customers' necessities and also it help to achieve the customer related objectives regardless of the manufacturing operating environment. . Shin et al. (2015) studied the various connection associated between the agile enterprises of korea and its aspects (technology capability, collaborative innovation, organizational learning, and internal alignment) using structural equation modelling. They studied and concluded that agility has direct and indirect effect through operational receptiveness on customer retention. Therefore, to sustain in long run, all organizations have to put efforts for enhancing the agility level. To become agile organization, AM is prerequisite in manufacturing environment. It is the competitive manufacturing paradigm enabling the mass customization efficiently coupled with high responsiveness to improve the performance of their businesses. In order to impart agile manufacturing system in difficult working environments, it is important to measure and improve the agility of the parallel manufacturing systems (Routroy et al., 2015). Successful benchmarking approach is applied in many areas and many research papers are reported in literature to improve the performance of the system, limited literature on benchmarking is very approach is not available on the application of AM for enhancing its agility performance. The agility, AM and some significant aspects related to AM (i.e., frameworks, enablers, impediments, outcomes and agility assessments, and benchmarking).

2. Literature review

The literature review of agility, organization capabilities and their relationship to achieve agility with different aspects in the manufacturing system has been done. The various techniques and methodology to conduct research reviewed and presented.

The agile manufacturing concept in organizations came about in 1991 and was first set out in a report entitled 21st Century Manufacturing Enterprise Strategy Yusuf et al., (1999); Cho et al., (1996); Hormozi, (2001); Vernadat, (1999).

Yusuf et al., (1999) gave big contribution towards competitive authority of agility as follows: speed, innovation, profitability, quality, and proactivity. Different aspects of agility which were proposed were related to different levels of organization. Fundamental agility refers to specific resources (people, machinery and management); micro-agility refers to the enterprise, and macro-agility to the inter-enterprise level. List of 32 agile attributes were proposed for describing an agile organization.

Sharifi et al. (2001). Proclaimed different aspects of agile manufacturing which were agility drivers, strategic abilities, agility providers, and agility capabilities. These factors represent the agility of the business situation creating instability and impulsiveness of the changes which drive an organization to adapt agility, Strategic abilities determined through factors such as responsiveness, competency, quickness, and flexibility were considered as main aspects of the agile organization that allow transformation to changes. From different manufacturing area the agility capabilities could be achieved. From

manufacturing areas agility providers can be derived: organization, technology, people, and innovation. They discussed that only by participating these benchmarks' agility could be achieved.

Tsourveloudis and Valavanis (2002) studied and concluded that framework for knowledge-based is used for capacity and valuation of manufacturing agility. Therefore overall agility can be evaluated from an organization, further agility parameters is proposed and grouped into production, market, people and information infrastructures.

Gunasekaran and Yusuf (2002) carried out the analysis of agile manufacturing definitions and therefore the results show similar-meaning of all the concepts. Responsiveness, flexibility and information technologies are the major keywords used in agile manufacturing definition.

Achian (2003) studied and identified that to achieve the concept of agile manufacturing information system has a major role and also identified that the low performance of information system is barrier to achieve agility in the manufacturing system. Coronda mondrgon (2004) proclaimed that agility of operations in various SMEs in advance and high tech manufacturing and concluded that information technology is a second most important enabler to achieve agility.

Ismail et al. (2006) studied and proclaimed that framework of strategic agility can combined outer limits and indicators for the betterment of organization agile capability. This proposed framework includes business environmental audit with a number of environmental disorder indicators and agility capability indicators covering product, process, operation, people, and organization. Customization was done as a product dimension to categorize into the areas, re-use, and ability to replace. This model encourages the mass customization pattern of manufacturing.

Sherehiy et al. (2007), also concluded that in manufacturing flexibility dependent on workforce than on technology aspect. The 'agility' describes and elaborate the intensity and potential face of internal and external events of organization (Taleghani et al., 2014). There is also increased ambiguity between the terms flexibility and agility. If flexibility is considered as precedent or subgroup of agility, then there is hardly any different while treating them exclusively (Thilak et al., 2015; Routroy et al.,2015) and therefore at critical and business network level, it must be flexible at process level for an organization to become agile (Ali et al., 2014; Thilak et al., 2015). Taleghani et al. (2014) investigated the main cause of the different factors which are affecting the organizational agility in a Sugar Company in Iran and they acknowledge that there is a serious and positive relationship between the six factors (i.e., speed, responsiveness, flexibility, competence, empowerment and job security) and organizational agility of the employees. . Nejad et al. (2014) investigated the entrepreneurial orientation and agility relationship in manufacturing firms using statistical analysis taking inputs from 100 manufacturing firms of Kerman Province. They confirmed a positive and significant entrepreneurial orientation and agility relationship. The agility in manufacturing organizations is the need of the hour and they should put effort to continuously enhance their agility. Liu and Liang (2015) proclaimed that advance technology manufacturing industries to achieve sustainable competitive advantage and concluded that it can be achieved by regularly

optimizing proper resource allocation alignment with resource-based operations strategy supported by the sense and respond idea of agile strategy implementations. Agile manufacturing in manufacturing system is one of the significant antecedents for a manufacturing organization to become agile and also to have an efficient and efficient agile supply chain. In the following sections, a literature review on AM is carried out to give a clear insight about them.

2.1 Organization capabilities

Organizational capabilities are highly valuable aspects of an organization and build a strong foundation for stable and sustainable competitive advantage. It is termed as an organization's capacity to engage in a range of productive activities that are most critical for the generation. Organizational capabilities importance has underline the considerable research in achieving and sustaining new product competitive advantage Grant (1996), Mateare (2004) and Saw (2006). During R&D of new product design, an organizations capacity for residing action depends upon in its abilities (Lansiti and Clark, 1994). A resource-based model was analyze which describe and identify organizational capabilities and also identify the empirical literature on new product further organizational capabilities was classified into four major categories, namely:, external integrative, technological, internal integrative and marketing capabilities Verona (1999). Galbreath (2008) diverted the organization internal perspective, has significant role on the variation of organization success is explained by their capabilities. Therefore, Adner (2003) proposed that some capabilities are more demanding than others in determining organization success. Also, investigation on organization capabilities have deviated their attention from technological or research and development capabilities to organizational capabilities. Capabilities of organization capabilities, having activities and procedures, embody individual, group and firm-wide knowledge. Organization historical background, indicate that organizational capabilities are distinctive and may have performance of high degree value, exception, instability and non-substitutability (Kaplan and Norton 2004). Further concluded that organizational capabilities entail an organization competence to extend a team of capable employees to perform a set of tasks or activities. Three categories of organization capabilities were categorized based on their influence on the research by different authors that are managerial capabilities, technical capabilities and output-based capabilities.

2.2 Organizational agility

Organizational agility is always a main interest area of researchers. Various researcher have revealed an immense interest on the conception of organizational agility. Chen et al. (2015) and Mao et al. (2014) studied Organizational agility characterization for the capability of any organization which deals with necessary market concerns by means of responses which are rapid and technical modernization which can modify market changes into different prospects. Two important attributes of agility are innovativeness and rapidness, where rapidness represents timely realization and specific reply to market changes and innovativeness focusses on the quality of the reaction. With multiple background researchers have inspected and analyzed organizational agility as an enhanced order of ability that collaborate organization into quickly sensing and

answering to the changes in customers' preferences and tastes, competitors' actions, government regulations, etc. and thereby generates augmented performance over a longer time frame Sambamurthy et al., (2003); Tallon and Pinsonneault, (2011); Wu et al., (2006); Bi et al., (2012); Cai et al., (2013). Further it was explain that organizational agility promote active integration of available resources, relationships and knowledge by means of precisely and rapidly sensing the market-related changes and quickly sending the signal to the organization so that in response to the signal, necessary business reconfiguration takes place with proper integration of the internal resources Cai et al. (2013),. This is certainly an extraordinary organization capability that aid IT professionals to make immediate and timely decisions regarding new product development or modifying existing product features, lines, etc. therefore, making organization more agile Nazir and Pinsonneault, (2012); Mao et al., (2014); Chen et al., (2015).

The research work in the literature gives a platform for the authenticity that organization capabilities were groundwork for backing various pillars of agility. In the analysis and possibility of this research work, agility having five dimensions particularly market flexibility (MF), product customization (PC), manufacturing performance (MP), and smart manufacturing (SM) and supply chain capability (SCM) were determined. Further, organizational capabilities have been classified into four constructs namely technology capability (TIC), In-house R&D (IRDC), manufacturing informatics (MI), risk management capability (RMC). Combining these associations between dissimilar organizational capabilities and agility constructs for resulting in attaining agility is characterize.

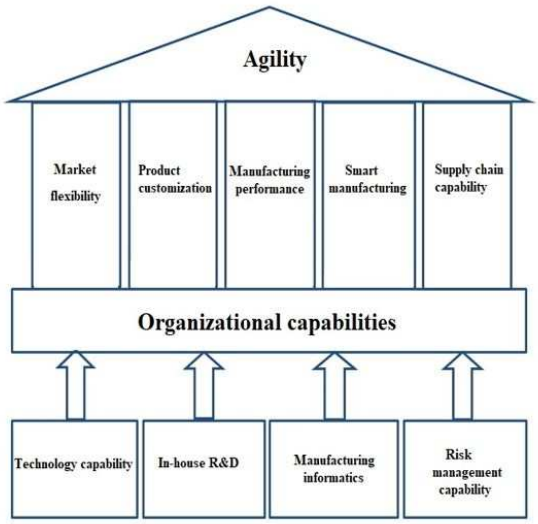

Fig. 1

3. Design of study

This part discuss and introduce complete methodology and strategy of study and approve

for carrying out the research work.

In this research cross-sectional research is used which is best suited for this type of survey based study and it is also identified and proved that it is widely used and acceptable and correlated to other methods. In this method cross-sectional method provide the various snapshot of the variables. Then in the second step the sample components selected is considered as a representative of some known universe. This approach is used to conclude the impact of organizational capabilities in managing agility in manufacturing system has been illustrated in **Fig.1.**

4. Survey questionnaire analysis

Manufacturing industry in India is a rising sector and it can consolidate the industrial development of the manufacturing sector in the country in many ways. In spite of this, manufacturing industry in Indian is still lagging to compete enough. Major reason behind this is presence of unorganized and organizations which are not registered small manufacturing units in different parts of the country. Another reasons are, uncertainty in orders, uneasiness in industrial conditions, power shortage and excessive rivalry from imports which are possible hazards to manufacturing industry in India. For making this survey more effective, the questionnaire design was done through extensive literature review and their validation was done with the help of consultant, academics and people in the senior position in the industry. Questions framed were done on the basis of five-point likert scale ranging from 1 to 5 designed to generate positive statistical measurements with the help of significant answers to barred closed questions.

Three stages were considered for data collection. First involves close discussion with the executives who are in the key position in the different manufacturing organizations, to confirm the effectiveness of the questionnaire. The main aim behind this is to approve whether the feedback are based on appropriate analysis in the next stage of the questions, questionnaire which was finalized was sent to 500 members selected at random. Feedback received were 150, consisting 30 percent of the response rate. Thus compares and justify well with the reply for studies in operations management Handfield (1995); Oberoi et al., (2008). Further rejection of ineffective feedback derive in 119 responses.

5. Reliability tests for validation of data

Consistent reliability within the system is used for the assessment of the survey instrument and scales by using psychometric test. Credibility of the test can be checked, Cronbach's a is the basic formula which has been evaluated for different organization capabilities and managing agility in manufacturing system which further ascertain dependent and independent reliability from the data collected . Values of Cronbach's for different variables has been shown in Table I. The Cronbach's values for all the dependent and independent categories, in excess of 0.6 indicates the significantly high reliability of data for various dependent and independent categories.

Basic principle of discriminate validity is that the index for different designs should not be so much correlated to each other so as to lead one to achieve that they extent the same

thing. If there were definitional overlaps between the various constructs this situation could arrive. Also, discriminate validity investigation represents the testing statistically whether two constructs differ (as opposed to testing convergent validity by measuring the internal consistency within one construct, as Cronbach's alpha does).

S.No.	Construct	Abbreviation	SD	Cronbach Alpha
1.	Technological capability	TIC	0.916	0.703
2.	In-house R&D	IRDC	0.927	0.769
3.	Manufacturing informatics	MI	0.952	0.788
4.	Risk management capability	RMC	0.913	0.701
5.	Market flexibility	MF	0.920	0.692
6.	Product customization	PC	0.912	0.855
7.	Manufacturing performance	MP	0.940	0.689
8.	Smart manufacturing	SM	0.937	0.693
9.	Supply chain capability	SCM	0.937	0.755

Table I

Correlated model representing 9 factor. This model is used to test the each elements and examine the discriminate validity. Various elements within-group and between-group variances for all the constructs are contained in Table II. Further diagonal cells contain the within-group variances, the off-diagonal cells in the lower triangle contain the between-group variances, and the off-diagonal cells in the upper triangle represent correlations among the constructs. As can be seen in the Table II, the within-group variances of any two constructs exceed the variance between those two constructs, thereby supporting discriminate validity.

	TIC	**IRDC**	**MI**	**RMC**
TIC	**.501**	.676**	.817**	.790**
IRDC	.368	**.592**	.767**	.680**
M1	.456	.465	**.622**	.796**
RMC	.392	.367	.440	**.492**

Table II Discriminant validity testing matrix (Independent)

	MF	**PC**	**MP**	**SM**	**SCM**
MF	**.480**	.719**	.863**	.723**	.729**
PC	.426	**.733**	.718**	.693**	.655**
MP	.409	.420	**.468**	.815**	.740**
SM	.347	.411	.386	**.480**	.658**
SCM	.381	.423	.382	.344	**.480**

Table III Discriminant validity testing matrix (Dependent)

Therefore, the data has been tested for convergent and discriminant validity and result found was that it is free from any systematic or non-random error.

6. Results and Analysis

Analytical investigation of different types of Indian manufacturing industry has done. From the extensive literature survey, the significant efforts to achieve agility was accomplish by very less number of manufacturing industries, while the remaining manufacturing industries have yet to made a significant crack concerning fulfilment of these drives.

This study proclaimed, main respondents indulge in this were the organizations that were responsible for making serious mediation in the field of agility. The selected organizations for study are those organizations which are aimlessly preferred organizations those have invested seriously to enhance their actual technology, In-house R&D facilities, development of new product, working with smart manufacturing and taking control of proper risk management to minimize the different risks in the organizations. These organizations are having major share in their specific area of product domain. All the different responses which are received then compiled and then analyze them seriously to study the achievements of various Indian manufacturing organizations with their related agility issues.

Therefore, to develop relationship between agility and organizational capabilities multiple regression and bivariate correlation and techniques have been used. The correlation role is significant for contributing to achieve agility in the manufacturing system in the organizations. Pearson correlation with the pairs greater or equal to 40 percentage show strong association which are statically significant at 1 percent level .The main main is to consider those factors, which are closely related to agility. First, the Pearson correlations values were found to understand the inter correlation among various organizational capabilities and aspect of agile manufacturing. In maximum number of cases the values of correlation coefficients (r) were found high and significant at 0.01 level. This results in significant relation of organizational capabilities with aspects of agility in manufacturing system. By primary method of SPSS, different values of correlation are as shown in Table II.

Agility	Significant Factor	Beta value	t-value	R/R^2 value	Adjusted R^2	F value	Tolerance/ VIF
MF	MI	0.478	4.277	0.777/0.60	0.594	138.84	0.367/2.739
	RMC						
PC	RMC	0.619	8.521	0.619/0.383	0.378	72.61	1/1

MP	MI	0.421	4.340	0.775/0.60	0.594	94.936	0.367/2.729
	RMC	0.397	4.095				0.367/2.729
SM	RMC	0.418	3.723	0.682/0.464	0.455	88.77	0.367/2.729
	MI	0.300	2.675				0.367/2.729
SCM	MI	0.345	3.501	0.834/0.696	0.688	192.14	0.272/3.671
	RMC	0.281	3.030				0.308/3.250
	TIC	0.269	2.762				0.279/3.580

Fig. II

The value of multiple correlation coefficient (R), for product customization (PC), is 0.619 also the value obtained from adjusted R^2 is 0.378, which specify the significance that 38.3% of the variance in product customization can be estimated from risk management capability. Therefore, as a result indicate that, only risk management (RMC) is statistically significant. Further, the table II depicts that F-probability is < than 0.001 and is important. Therefore, it tells us that the blend of the independent variables significantly estimate the product customization. Further beta coefficients with similar interpretation correlation coefficient. Also, it indicates that t-value variable is whether meaningfully participating to the equation for predicting variable from the set of dependent variables. The tolerance for each variable is > 0.622, demonstrating that there is no problem of multi collinearity.

The table II explain that multiple correlation coefficient (R), for manufacturing performance (MP), is 0.775 whereas the adjusted R^2 is 0.594, leading to the significance that 59.4% of manufacturing performance variance can be concluded from manufacturing informatics and risk management capability. Therefore, as a result indicate that, manufacturing informatics (MI) and risk management (RMC) is statistically. In addition, the table II shows that F-probability is < than 0.001 and is significant. This proclaim that the combination of the independent variables significantly predict the manufacturing performance. The standardized beta coefficients are interpreted similarly to correlation coefficient or factor weights. Further the t-value signifies that variable is significantly contributing to the equation for predicting variable from the whole set of dependent variables. The tolerance for each variable is > 0.406, indicating that there is no problem of multi collinearity.

The table II shows that the multiple correlation coefficient (R), for smart manufacturing (SM), is 0.682 and the adjusted R^2 is 0.455, leading to the connotation that 45.5% of the variance in smart manufacturing can be predicted from risk management capability and manufacturing informatics. Therefore, as a result indicate that, risk management (RMC) and manufacturing informatics (MI) is statistically significant. In addition, the table 4.2 shows that F-probability is less than 0.001 and is significant. This indicates that the combination of the independent variables significantly predict the manufacturing performance. The standardized beta coefficients are interpreted similarly to correlation coefficient or factor weights. The t-value indicates that whether variable is significantly contributing to the equation for predicting variable from the whole set of dependent

variables. The tolerance for each variable is > 0.545, indicating that there is no problem of multi collinearity.

Similarly the multiple correlation coefficient (R), for supply chain management (SCM) there is no problem of multi collinearity.

7. Conclusions

Present research work proclaim the evidence relationship between a parallel choice and auxiliary elements of organizational capabilities for achieving agility in different manufacturing industries in India. Further the recommended research groundwork investigate the impact of various organizational capabilities in managing agility in Indian manufacturing system. Organizational capabilities of the manufacturing system have a great impact on agility is also proposed. Further contribution of this proposed model to the existing literature in distinct ways.

It has been also acknowledge that considerable key addition of this research work is recognition of various organizational capabilities and agility for Indian manufacturing system. Further, it has been described that manufacturing industries are able to survive and compete not only due to their ability to exploit but also the use their existing resources, and also they need to handle their ability to restore and expand their organizational capabilities.

At last, for practitioners and academics alike, this research work show an important role to presents the possibilities for building organization capabilities, and this is the key elements for the growth of different Indian manufacturing industries pursuing to boost their agility.

In order to carry out smart manufacturing, the organizations must structure their Technological and manufacturing informatics capabilities. Which can be further associated to the reality that manufacturing units ought to strengthen and realign their In-house R&D capabilities by establishing technological, infra structural and cerebral capability in-house. Therefore, these capabilities can be tactfully derived to initiate the fulfilment of increasing demand of customized product capability in relation of feedback. Supply chain agility can be increased by expanding technological capabilities. It can be done by investing in latest technologies and moreover emphasis smart working and early risk detection in the organization.

In this research work, the study of the effect of organizational capabilities on managing agility in different Indian manufacturing systems has been done. Although India has a significant and bold manufacturing base, but generalization of various conclusions of the research is prone to investigation. The importance of this research work was limited but can be enhanced to further classification of different industries too. In this study, the item measures recognized for different aspects are treated to be equally important. Some of which are of more importance than others in actual life conditions. The research work can be continued by affixing suitable weights to these item measures by using qualitative methods.

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