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Article

Modeling of critical factors for integrating sustainability with innovation for Indian small- and medium-scale manufacturing enterprises: An ISM and MICMAC approach

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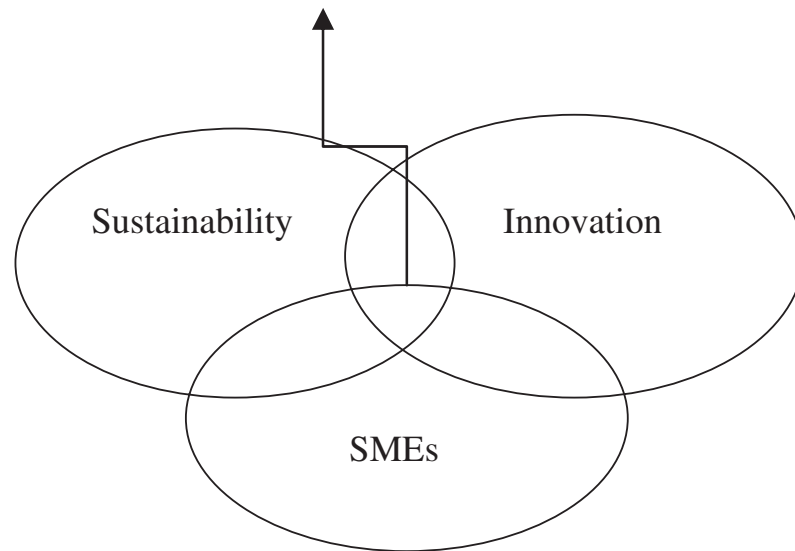
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Sustainable Oriented Innovation for SMEs



INTEGRATION OF SUSTAINABILITY WITH INNOVATION FOR SMALL & MEDIUM SCALE ENTERPRISES (SMEs) LEADING TO SUSTAINABLE ORIENTED INNOVATION FOR SMEs

MANAGEMENT | RESEARCH ARTICLE

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MANAGEMENT | RESEARCH ARTICLE

Modeling of critical factors for integrating sustainability with innovation for Indian small- and medium-scale manufacturing enterprises: An ISM and MICMAC approach

Bisma Mannan^{1*}, Sonal Khurana¹ and Abid Haleem¹

Abstract: The growth of any country depends upon the existence of small- and medium-scale enterprises (SMEs). The greater the number of SMEs present in any country, the economy of the country increases in the same proportion. This paper uses the qualitative research technique to study the critical factors which affect the integration of sustainability with innovation taking into account Indian manufacturing SMEs. An ISM approach is applied to establish the interrelationship between the various critical factors. And with the help of Fuzzy Micmac technique, driver dependence power diagram is created. From our analysis, it has been found that “government regulation” has the highest dominating power which helps in successful execution of integrating sustainability with innovation. Variables “employee nature” and “working culture” have the highest dependence power. The success of these variables depends on the success of the variables below them. Finally, the limitations of using the above techniques are discussed and then the suggestions are made for the further research.



Abid Haleem

ABOUT THE AUTHORS

Bisma Mannan and Sonal Khurana are pursuing their doctoral research under the supervision of Abid Haleem. Their papers were published in three national conferences and six international conferences. One of their papers is published in IJCA, USA. This paper is a result of more than a year's hard work of the three authors, who have also taken extensive support from learned experts.

Abid Haleem is with Jamia Millia Islamia, a central University of Indian Government, and has headed the Mechanical and Management departments. He has supervised more than 18 researchers and more than 170 publications to his credit in his core. He is actively involved in teaching as well as research work at graduate, postgraduate and PhD levels in the areas of technology management, innovation, industrial engineering, green practices, supply chain management, business process re-engineering, information resource management, e-governance, technology management, and allied areas.

PUBLIC INTEREST STATEMENT

Small- and medium-scale enterprises (SMEs) have become the engine of economic growth. They play even a bigger role in developing countries like India as they are the main employment generators. Innovation has become very important these days because of the tough competition in the market. Incorporating sustainability with innovation has become essential for the survival of SMEs. This manuscript presents a study of the critical factors involved in integration of sustainability with innovation for Indian manufacturing SMEs. An ISM approach is applied to establish a structural model of the selected critical factors. And MICMAC analysis is done to strengthen the ISM model.

Subjects: Engineering Project Management; Enterprise Resource Management (ERP); Industrial Design; Operations Research; Production Systems; Quality Control & Reliability; Supply Chain Management

Keywords: sustainability; innovation; small & medium scale enterprises (SMEs); interpretive structural modeling (ISM)

1. Introduction

Globalization of markets, quick technological advances in technology, and shorter product lifecycles are forcing small- and medium-scale enterprises (SMEs) toward innovation which has to be sustainable to gain competitive advantage. Various reports of media in the previous couple of years have been investigated and it has been found that enterprises from varied industries are either in the process of launching or are progressing to launch sustainable goods. It is not possible nowadays to think about economic development without considering preservation of the environment at the same time and giving shared advantage to the society (Khurana, Mannan, & Haleem, 2014). In this way, corporations are routinely looking to utilize extensive variety of input resources which have better productivity and increased responsibility in their products and technologies used to manufacture the products.

Today, the latest patterns demonstrate that corporations are giving a lot of importance to sustainable product innovation. Ottman, Stafford, and Hartman's (2006) study stated that there is no user good which has no effect on the surroundings; in industrial terms, the terms "green good" and "sustainable good" are majorly used to portray the goods which aim in shielding or upgrading the green habitat by preserving energy and/or resources and also work hard to reduce or eliminate usage of harmful agents, pollution, and waste.

Joseph A. Schumpeter was the first who used the innovation concept in his research study. He defined innovation as the implementation of a new or significantly improved product, process, etc. Innovation is important for the survival of the enterprise in the market and for the growth of the economy. In the present scenario, the vital aspect is that of innovation, and not the cost, as the critical factor for survival in the market. So, large enterprises play an important part in the innovation procedure, but small and medium enterprises also play a crucial role in application of new knowledge in the marketplace. Also, the association between competition in the market and innovation is nonlinear and is complex. Excessive competition encourages innovation, but intense clashes demoralize change and innovation. Our research study aims to identify the critical factors which affect integration of sustainability with innovation for Indian SMEs. As SMEs have limited resources, to what extent they are able to implement the innovative approaches is the focus of the study.

2. Literature review

2.1. Background

A study conducted by Mc Kinsey & Company on climate change led to the conclusion that 60% of the executives who were asked questions take into notice climate change essential and are keen to showcase new items which are eco-friendly. These attitudes by the enterprises give us the direction that the firms have understood the need of developing sustainable products for survival in the market.

2.2. Small- and medium-scale enterprises

Small- and medium-scale enterprises are considered as drivers of growth of the economy and they play an important role in the developing economies by giving their contribution to the national gross domestic product and also help in generation of employment as they are labor intensive in nature. These enterprises are seen in all major manufacturing subsectors and about 85% of the total manufacturing establishments in Asia are SMEs (Thiruchelvam, Kumar, & Visvanathan, 2003). Also, taking the case of the developed countries, in Italy, Japan, and France, SMEs accounted for 99% of the total

number of enterprises. In the USA, there were more than 2000 million SMEs, accounting for 98% of the total number of enterprises, although America was famous for its large enterprises (Bayarçelik, Taşel, & Apak, 2014).

With the depletion of natural resources and continuous destruction of biodiversity, ways of engaging enterprises in ecological aspects have to be found out by both academicians and practitioners. There is growing acknowledgment of the influence of SMEs on the environment. This has increased the research of integrating ecological management practices into innovation procedure among the smaller enterprises.

2.2.1. Small- and medium-scale enterprises: Indian perspective

For the last three decades, proper economic development in our country has taken place under certain severe constraints (Mannan & Khurana, 2012). The more vital of these constraints are: inadequacy of resources along with capital, equipment, technology, skills, etc., high growth rate of population, and adverse land-man ratio. Besides this, the establishment of basic and heavy producer goods industries, that is an important pre-requirement for laying the base of rapid industrialization, economic growth involves a heavy strain on restricted resources of capital and skills and provides limited employment opportunities. It is in this context that great emphasis has been placed in our industrial policy statements and programs for the promotion and development of small industries which do not make high demand on scarce capital resources and also create much larger opportunities for employment, including self-employment.

2.3. Sustainability

Sustainability has been defined by Forestry Commission of Great Britain as the concept having four goals. The first one deals with the social progress that caters to the need of everyone. Second one is for the environment protection. Third one deals with the judicious use of natural resources and the last one involves task of maintaining high and stable levels of growth of the economy and in employment generation. The definition of “Sustainability” as given by various researchers is shown in Table 1.

2.4. Innovation

Schumpeter and Opie (1934) is generally regarded to be among the first to think of the procedure of innovation in organizations. According to him, innovation is considered as the formation and execution of combinations which are novel or different. These different combinations can be associated with new goods, services, work processes, markets, delivery systems, and policies. “Innovation” as defined by various researchers is given in Table 2.

2.5. Critical factors of integrating sustainability with innovation for SMES

Critical factors (CFs) are key factors/enablers/activities required for ensuring the success of any business/phenomenon to happen and necessary for an organization to achieve their goals, which are required to be identified, evaluated, and focused (Khurana et al., 2014). Various critical factors which affect the integration of sustainability with innovation for Indian SMEs are shown in Table 3.

2.5.1. Employee nature

The importance of effective strategy for improving competitiveness of SMEs is being stressed. Risk allocation preferences should be found out and are essential for any task’s risk-managing procedure, and should be catered to as early as possible. In addition, Xenidis and Angelides (2005) suggested that identifying, classifying, and presenting important risks are essential for analyzing the potential impact of a project and for providing practitioners with an early warning of the project and the time to develop strategies.

Most of the employees in SMEs do not want to change and do not like to be innovative. On the other hand it is human nature to be innovative from the Stone Age to ceramics and composite material age to nano particle age. Here resistance to change is barrier to innovation while change management is enabler to innovation for SMEs, so Human nature can be taken as critical factor to innovation for SMEs.

Table 1. Sustainability definition by various researchers

S. No.	Reference	Definition of sustainability
1	The Forestry Commission of Great Britain	The first one deals with the social progress that caters to the need of everyone. Second one is for the environment protection. Third one deals with the judicious use of natural resources and the last one involves task of maintaining high and stable levels of growth of the economy and in employment generation
2	The US National Research Council	The reduction by human beings will stay on in the future, so the target should be to cater to the demand of goods and services used by the humans, indefinitely
3	The MSA (Manufacturing Skills Australia)	Established the operating definition of sustainability with extra in depth particulars with respect to environmental, social, and economic factors. It is categorized into internal and external factors. For example, the internal factors of ecological sustainability will be to cut down on the cost and waste
4	Werbach, A	He established the definition of sustainability with four components: social, economic, environmental, and cultural. The cultural construct has been added, which implies, to safeguard and understand the worth of the diversity through which communities manifest their identity and develop traditions across generations

2.5.2. Working culture

O'Regan in 2005 took culture as the most common obstacle to the execution of innovative ideas. SMEs have adjustable introduction cultures that are generally defined by less obstruction to change, low risk reluctance, and tolerance of ambiguity (Saleh & Wang, 1993).

Noteworthy, innovative idea may also be linked with an open management technique, as Johannessen (1994) stated that it can be buttressed through communication-related IT. Norris (1999) considered that the presence of a leader was one of the most vital coordinators in the selection of technologies by government organizations.

“In our case risk aversion culture is taken as barrier to innovation for SMEs while risk taking capacity is taken as enabler to innovation”. It depends on the culture of the SMEs that they make their employees as a champion and risk taker or the employee do not want to take risk due to the fear of be failed in their goals of the organization. So culture is taken as critical factor to innovation for SMEs.

2.5.3 Funding

The financial resources should be available to improve or frame organizational IT framework, which is one of the biggest forecasters of introduction (Mohr, 1969).

Thus, a large difference in IT innovation between private and government organizations can be judged by the magnitude of budget availability in adopting new IT. But, as the total budget allocation varies from organization to organization, the percentage of the IT budget in the total budget can be considered as the way to find out the level of financial support (Kim & Bretschneider, 2004).

Table 2. Definition of innovation by various researchers

S. No.	Reference	Definition
1.	Schumpeter and Opie (1934)	He depicted innovation as the creation and implementation of different combinations
2.	Drucker (1985)	Innovation is the main tool of entrepreneurs, the approach by which they find out novel ideas or innovation as an open door for a new business venture or service delivery
3.	UK DTI (2004)	It is the significant implementation of novel concept
4.	Albury (2005)	Significant introduction is the developing and implementing new procedures, items, services and techniques of delivery which lead to noteworthy enhancements of results, proficiency, effectiveness or quality
5.	Dean (2006)	It is the significant creation, execution and usage of fresh or structurally enhanced items, procedures, supply of services or forms of organization

Table 3. Critical factors of integration of sustainability with innovation for SMEs

S. No.	CFs to innovation	Authors
1	Employee nature	Singh, Garg, and Deshmukh (2008), Wang and Ahmed (2004), Liu, Kwan, and Chiu (2013), Xenidis and Angelides (2005), Bessant and Tidd (2007), Lundvall (2007), McAdam and Armstrong (2001), Tourigny and Le (2004)
2	Working culture	Terziovski (2010), Johannessen (1994), Reich and Benbasat (1996), O'Regan and Ghobadian (2005), Acs et al. (1997), Saleh and Wang (1993), Damanpour (1992), Cooper, Frank, and Kemp (1996), Hudson, Smart, and Bourne (2001), Fuchs, Mifflin, Miller, and Whitney (2000), Varis and Littunen (2010)
3	Funding	Mohr (1969), Kim and Bretschneider (2004), Kingombe et al. (2011), Grimsey and Lewis (2002), Cooke, Gomez Uranga, and Etxebarria (1997), Hoffman, Parejo, Bessant, and Perren (1998), Edquist (1997), Khurana, Khan, and Mannan (2013)
4	Skill and capacity building	Mohr (1969), Daft (1978), Johannessen (1994), Kamal (2006), Kaufmann and Tödtling (2001), Furman, Porter, and Stern (2002), Rush and Bessant (1992), Mohnen, Mairesse, and Dagenais (2006), Mohnen and Raller (2005)
5	Customer	Xenidis and Angelides (2005), Mathiyazhagan, Govindan, NoorulHaq, and Geng (2013), Mudgal, Shankar, Talib, and Raj (2010), Ageron et al. (2012), Kumar, Singh, and Shankar (2015), Luthra, Garg, and Haleem (2015), Mannan, Khan, and Khurana (2013), Srivastava (2013)
6	Market	Rothwell (1977), Li (2011), Singh et al. (2010), Kumar et al. (2015), Singh et al. (2008), Drumwright (1994), Ansari, Kharb, Luthra, Shimmi, and Chatterji (2013), Hadjimanolis (1999), Hall (2001), Mannan, Khan, and Khurana (2012), Mannan, Jameel, and Haleem (2013), Bowen, Cousins, Lamming, & Farukt (2001)
7	Governance	Kamal (2006), Moon and Bretschneider (1997), Bingham and McNaught (1976), Brudwney and Selden (1995), Luthra et al. (2010), Cooke (2015), Khurana, Khan, and Mannan (2012), Lal and Haleem (2009), Segarra-Blasco, Garcia-Quevedo, and Teruel-Carrizosa (2008), Nelson (1993)
8	Reward and motivation	Dubey and Ali (2014), Zhu et al. (2008), Luthra et al. (2013), Narain, Yadav, and Antony (2004), Dewangan, Agrawal, and Sharma (2015), Jayant and Azhar (2014), Luthra, Qadri, Garg, and Haleem (2014), Walker, Di Sisto, and McBain (2008)

In most countries, the government assumes responsibility for financing and building infrastructure (Kingombe, Massa, and te Velde, 2011). In recent decades, however, private entities have begun to provide financing (Grimsey & Lewis, 2002).

“Lack of finances is taken as barrier to innovation for SMEs while adequate funding is taken as enabler to innovation. The SMEs suffer too much from financial aid from the government and sponsored in develop countries like India and china. On the other hand in developed countries there is a lot of support from government side and sponsored side to adopt new technology setups, skill training program for employees and training institutions. So funding can be taken as critical success factor to innovation for SMEs.”

2.5.4. Skill and capacity building

Personnel having proper skills for generating novel ideas is one of the essential factors for IT innovation adoption (Mohr, 1969), and innovative ideas are generally put forward by personnel who is having expertise knowledge in the desired field (Daft, 1978). The increased knowledge will lead to rapid progress of information technology and research in the same area. This transformation will decrease the cultural variation and the psychological perceived geographical distance between various information systems (Johannessen, 1994).

The desired skill of the personnel is an essential factor that can act as the obstacle or as an enabler in the introduction of novel technologies. The accumulation of the enterprises in the region and their association with research institutions act as a source of knowledge and specialization which encourages the establishment of novel technology and thus affects the innovative capacity of the enterprise (Frenkel, 2001).

“Lack of skilled personnel is barrier to innovation while availability of skilled personnel is enabler to innovation for SMEs. So knowledge and capacity building can be taken as critical factor to innovation for SMEs.”

2.5.5. Customer

Indian industries are also facing extreme pressure from consumer’s ecological knowledge and stringent ecological rules to include ethical and environmental considerations in all facets of traditional supply chain management (Luthra, Kumar, Kumar, & Haleem, 2011).

Several important issues concerning consumers as the enabler for greening supply chain management practices have been investigated. In establishing the role of buying in ecological management, it was concluded that demands of the consumer that include a long-term supply chain aspect have increased positive effect on ecological management in contrast to consumer requests that include an impractical timeframe (Carter & Dresner, 2001).

“Lack of customer’s responsiveness to any new products, new services and new technologies is barrier to innovation while fast customer’s responsiveness is enabler to innovation for SMEs. So customer responsiveness is critical factor to innovation for SMEs.”

2.5.6. Market

The major part of outstanding introduction depends on the demands in the market (Rothwell, 1977). The business organizations may also apply GSCM as a decision-making approach to earn monetary gain in the market (Li, 2011). Small-scale organizations focus on bettering the effectiveness of operational functions with proper supply chain management for competition in the world market (Singh, Garg, & Deshmukh, 2010). Data show that India, the fifth largest country with respect to gross national product (GNP) and purchasing power parity (PPP) (World Bank, 1999), and a customer base of over a billion (CMIE, 2000), makes up one of the fastest growing markets in the world.

In market failures which are related with innovative actions, we can categorize three directions: first, the failures linked to the challenges that innovative firms have to face when dealing with all the returns linked to their introduction of new concept, i.e. “spillover failures;” second, related to the failures produced by the problems the innovative firms have to face when searching for the partners (collaborating companies, research public centers, technological transfers centers, universities, etc.), who can execute their innovative ideas (coordination and systemic failures); and finally, the failures related to the inadequate knowledge on the evolution of the market or the latest technology (“information failures”).

“In this context, limitation of market is taken as a barrier to innovation while availability of market is taken as an enabler to innovation for SMEs.” So market can be taken as a critical factor to innovation for SMEs.

2.5.7. *Governance*

The legislative body (the local government) is as vital as top administrators, as budget allocation and other legislative supports are finally authorized by local governments. Like top administrators, local governments’ IT innovativeness and knowledge form a crucial part of support from administrative authorities (Kamal, 2006).

“Government’s regulation can be taken as a formal barrier to innovation and has a significant effect on the SMEs for innovation while government’s R&D and technology policy acts as an enabler to innovation for SMEs. So governance can be taken as a critical factor to innovation.”

2.5.8. *Reward and motivation*

Rewards and incentives influence the behavior of employees in any organization (Luthra, Garg, & Haleem, 2013; Zhu et al., 2008). Narain in 2004 had also proposed that availability of trained personnel: education, skill, and motivation of employees and management, is the key factor which affects the adoption of FMS.

Encouraging the personnel through incentives and many other such acknowledgments motivates each employee in the firm. The ability for continuous learning, buttressed by a stress-free work atmosphere, encourages an employee to innovate that can further speed up the execution procedure of FMS (Dubey & Ali, 2014).

“In this context, lack of ethical values is a barrier to innovation while legal framework is an enabler to innovation for SMEs. So reward and motivation can be taken as a critical factor to innovation for SMEs.”

3. **Methodology**

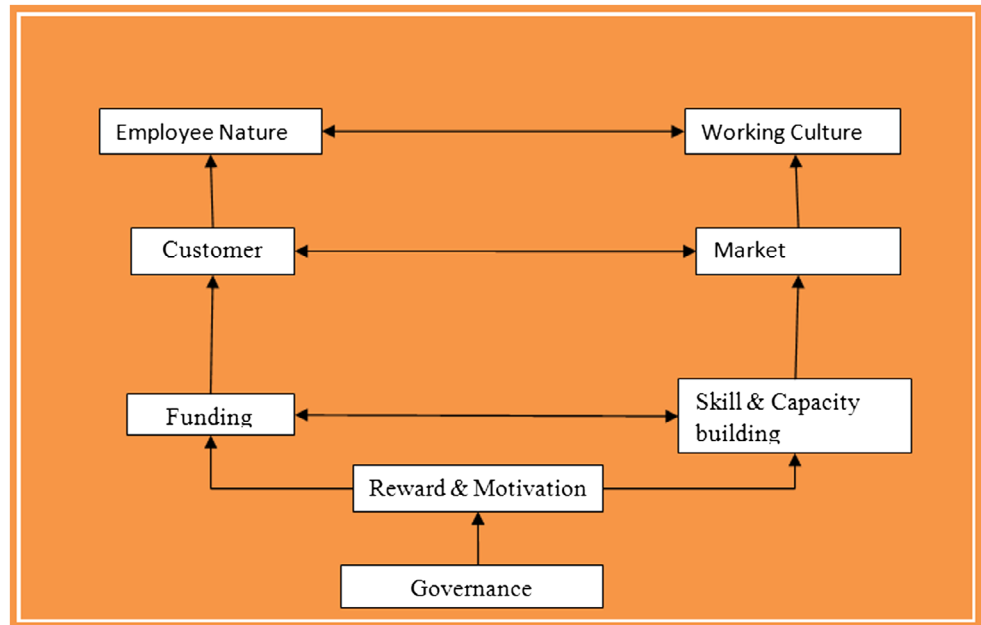
Qualitative research has been incorporated. In the present study, questionnaire was developed after reviewing the related literature and interviewing the experts of the related field. After this, the Delphi approach was applied. In this, the baseline questionnaire was mailed to the experts of the related field and based upon their responses on the Likert scale, critical factors which affect the integration of sustainability with innovation were obtained. Then, the ISM approach was applied to establish the model depicting the driving and the dependence power of the selected critical factors.

3.1. **ISM approach**

The mathematical basis for ISM methodology can be found in the research done by Harary and the philosophical basis which led to the establishment of this approach has been given by Warfield in 1974. The basic idea of the approach is to utilize the expertise of the people having knowledge in the desired field and then decompose a complex system into several subsystems and establish a multi-level structural model. ISM has the following steps:

- (1) Factors/variables influencing the system are listed down.

Figure 1. ISM-based structural model of critical factors affecting integrating of sustainability with innovation.



- (2) This is followed by finding the relationships between the factors. Pair wise comparison is performed among the factors to find out the direction of their relationship.
- (3) Structural self-interaction matrix (SSIM) is established from the factors using the opinion of the experts (Mannan, Khurana, & Haleem, 2012). Based on the answers of the persons having expertise in the field of study, a table is prepared. Table 4 depicts the SSIM for the present case of the study.
- (4) This is followed by development of reachability matrix which is a matrix consisting of zeroes and one. This is represented by Table 5. It is then checked for transitivity. Table 6 represents the final reachability matrix after incorporating the transitivity. This states that if there is a relation between variable A and variable B and variable B and variable C, then there is a relation between variable A and variable C.
- (5) Partitioning of the reachability matrix is performed.
- (6) From the pairwise relationships of the reachability matrix, a directed graph is drawn and transitive links are removed. This is shown by Table 7.
- (7) The final diagraph is transformed into an ISM by changing the factor nodes with statements. Figure 1 represents the ISM-based structural model of critical factors affecting integrating of sustainability with innovation.

Four notations are used to represent the direction of the relationship between the criteria (i and j):

- V criterion i will help in achieving criterion j;
- A criterion i will be achieved by criterion j;
- X criterion i and j will help achieve each other; and
- O criterion i and j are unrelated

3.2. MICMAC analysis

From the MICMAC analysis, we conclude the following (refer to Figure 2):

- Factors “governance” and “reward and motivation” have high driving power and weak dependence power. These are referred to as the independent variables.

Table 4. Structural self-interaction matrix (SSIM) for critical factors

S. No.	Factor	8	7	6	5	4	3	2
1	Employee nature	A	A	O	O	A	V	X
2	Working culture	A	A	O	A	A	A	
3	Funding	A	A	O	V	V		
4	Skill and capacity building	A	A	O	V			
5	Customer	O	O	X				
6	Market	A	A					
7	Governance	V						
8	Reward and motivation							

Table 5. Initial reachability matrix for critical factors

Factor	1	2	3	4	5	6	7	8
1	1	1	1	0	0	0	0	0
2	1	1	0	0	0	0	0	0
3	0	1	1	1	1	0	0	0
4	1	1	0	1	1	0	0	0
5	0	1	0	0	1	1	0	0
6	0	0	0	0	1	1	0	0
7	1	1	1	1	0	1	1	1
8	1	1	1	1	0	1	0	1

Table 6. Final reachability matrix for critical factors

Factor	1	2	3	4	5	6	7	8	Driving power
1	1	1	1	1*	1*	0	0	0	5
2	1	1	1*	0	0	0	0	0	3
3	1*	1	1	1	1	1*	0	0	6
4	1	1	1*	1	1	1*	0	0	6
5	1*	1	0	0	1	1	0	0	4
6	0	1*	0	0	1	1	0	0	3
7	1	1	1	1	1*	1	1	1	8
8	1	1	1	1	1*	1	0	1	7
Dependence power	7	8	6	5	7	6	1	2	42

Note: The final reachability matrix has been constructed by incorporating transitivity into initial reachability matrix of Table 5.

*Signifies transitivity.

Table 7. Levels for critical factors

Factors	Reach ability set	Antecedent set	Intersection	Level
1	1, 2, 3, 4, 5	1, 2, 3, 4, 5, 7, 8	1, 2, 3, 4, 5	I
2	1, 2, 3	1, 2, 3, 4, 5, 6, 7, 8	1, 2, 3	I
3	3, 4	3, 4, 7, 8	3, 4	III
4	3, 4	3, 4	3, 4	III
5	5, 6	3, 4, 5, 6, 7, 8	5, 6	II
6	5, 6	3, 4, 5, 6, 7, 8	5, 6	II
7	7	7	7	V
8	8	7, 8	8	IV

- Factors “skill and capacity building,” “funding,” and “employee nature” have strong driving and strong dependence power. They are referred to as the linkage variables.
- Factors “market,” “customer,” and “working culture” have strong dependence power and weak driving power. They are referred to as the dependent variables.
- Factors which have weak driving and weak dependence power are referred to as the autonomous variables. There are no such variables.

4. Result and discussion

The major requirement of the present study was to identify the critical factors involved while incorporating sustainability with innovation for Indian manufacturing SMEs. It was followed by establishing a relationship among them in a structured form to depict driving and dependence natures of the factors. The relevant information was gathered by interaction with the experts of the related field. Extra care was taken to achieve accurate and reliable results. The ISM technique has been found appropriate to model these factors. This technique is widely used by the researchers like A. Haleem, R. Lal, Y. Geng, S. Luthra, and V. Kumar on similar problems to transform the unstructured model of the system into a structured one.

The selected critical factors were classified as drivers and dependents depending upon their capabilities of driving or depending on other factors as shown in Figure 1. The results from the model help us in making the conclusion that all the chosen factors influence sustainability-oriented innovation and no factor is an autonomous factor as there is no factor which lies in cluster 1 (refer to Figure 2). This shows that the factors have been chosen with due care and diligence. The results from the study show that the factor “Governance” among the critical factors has been identified as a bottom-level independent critical factor driving the successful innovation for SMEs implementation. Factor “skill and capacity building” also has high driving power. “Employee nature” and “working culture” among the critical factors have been identified as top dependence variables in the ISM model.

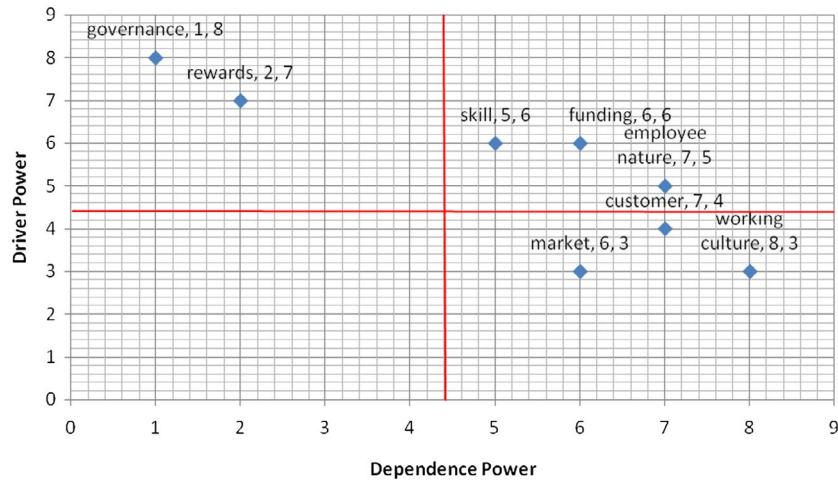
Governance has been found to have the highest dominating power, followed by reward and motivation at the second rank. Funding and skill and capacity building are ranked third in position; customer and market are placed fourth; and employee nature and working culture have the lowest dominating power. Proper reward and motivation of the employees will improve the work culture of the firm. Favorable government rules and regulations will help the markets improve. Skill and capacity building, funding, and employee nature have strong driving and dependence powers. These factors will help manufacture a sustainable product which will satisfy the customer, improve the market, and create a cordial working culture in the firm. Also, greater amount of skill and funding will depend on the incentives given by the government, programs launched by the government for the promotion of SMEs toward sustainable production. The ISM model (Figure 1) revealed the contextual relationship of identified critical factors (CFs) and it helped develop a hierarchical model. The driver dependence diagram gives some valuable insights into the relative importance of CFs and interdependencies among them. The digraph depicts the linkages among various CFs. Excellent governance having driving power of 8 and dependence power of 1 emerged as the most important CF of innovation for SMEs. The same has been depicted using FUZZY MICMAC technique as depicted by the driver dependence graph which is used to strengthen the model prepared by the ISM approach.

This manuscript presented a study in which emphasis was laid on establishing a structural model to find out the factor which has the major influence in integrating sustainability with innovation for Indian SMEs. And this can act as a decision-making tool for policy-makers which can influence their decision with respect to SMEs.

5. Limitations and future scope

This study suffers from few limitations also. The association among the critical factors depends on the expert’s expertise in the field of study. The person who is judging the variables or the association of the critical factors can be biased and this might affect the final outcome. And since the models

Figure 2. Driver and dependence powers' graph for critical factors which affect the integration of sustainability with innovation for Indian SMEs.



used can differ from industry to industry, accuracy determination and comparison are difficult due to the lack of any common base or context.

In the present study, the ISM model has been developed among the factors.

These models have been established based on input from two sources:

- (1) Opinion of the experts as discussed in the ISM and fuzzy MICMAC techniques;
- (2) Review of the literature

But these models are not statistically verified. Structural equation modeling (SEM), also known as linear structural relationship approach, has the ability of verifying these hypothetical models. Thus, it may be used in further research to verify these models. When we compare ISM and SEM, we should know that SEM has the ability of statistically verifying an already developed theoretical model; it cannot establish an initial model for testing. In contrast to this, ISM has the ability to establish an initial model with the help of managerial techniques such as brain storming and nominal group techniques (NGT) etc.

It can be suggested that because of the complementary nature of both these techniques, future research can be directed in first establishing an initial model through ISM and then verifying it by applying SEM.

6. Conclusion

Innovations are important for the financial growth of SMEs all over the world. In the present research, major critical factors have been identified which help in successful execution of integrating sustainability with innovation for SMEs in India. The decision model is based on the ISM technique.

ISM technique is used to establish a structural model of the selected critical factors. The decision-makers had to answer a few questionnaires depicting the strength of the selected critical factors and this process enhances/refines the current decision-making process. The research done previously such as that done by Talebi in 2012 indicates that the factor affecting SMEs innovation the most is the stage of industries followed by demand, industry–university linkage, attitude to work change, and size and age. The result of our study shows that “governance” is the key driving factor which helps in the successful implementation of integrating sustainability with innovation for Indian manufacturing SMEs. “Employee nature” and “working culture” have the highest dependence power. The same has been shown by the driver dependence diagram in Figure 2.

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