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Network Cooperation, Innovation, Internationalization and Economic Performance of SMEs: An Exploratory Study

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Abstract This paper explores the relationship between network cooperation, innovation, internationalization and economic performance of manufacturing small and medium enterprises (SMEs) of engineering goods industry located in Bangalore city, India. At the outset, it is observed that SMEs receive the maximum assistance in the realm of product specifications. Moreover, they do not resort to manufacturing new products as much as they resort to product modifications or process improvements. Further, it is found (using Chi-square test of independence) that higher the network assistance received from an external network, greater is the innovation performance of SMEs. Subsequently, using analysis of variance (ANOVA), export intensity (proxy for internationalization performance) of SMEs is found to have a significant positive association with both the degree of their network cooperation and of their innovation performance. Lastly, it is observed that higher the degree of each of network cooperation, innovation performance and internationalization performance, better is the economic performance (measured by total sales turnover) of SMEs. These results have significant implications for the policy makers of the country to give due attention to network cooperation, innovation and internationalization as the means of enhancing the economic performance of SMEs.

Keywords Network cooperation, economic performance, small and medium enterprises (SMEs), internationalization, innovation

I. Introduction

It is important for SMEs to be competitive to sustain, survive and grow in the competitive global environment. To achieve competitiveness for sustenance and growth, SMEs in general may resort to network cooperation

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through interlinkages, innovation or internationalization. But there is a lack of attention to the importance of network cooperation in internationalized and innovative SMEs, particularly manufacturing SMEs. Hence, the purpose of our paper is to probe the pair-wise associations between network cooperation, innovation performance and internationalization performance of manufacturing SMEs. Moreover, the study attempts to explore the individual association of these three constructs with the economic performance of SMEs. Towards this aim, the paper defines the constructs involved in the study and establishes the relationship between them with the help of existing literature.

To start with, network cooperation refers to linkages that a firm formulates with other firms (inter-firm cooperation) and with research institutes and universities to sustain, grow and succeed by deriving a plethora of benefits. SMEs make networks to access knowledge about new products/processes and to acquire new technical capabilities and marketing skills (Hall and Bagchi-Sen, 2007). SMEs engage in inter-firm cooperation to tap into sources of know-how located outside the boundaries of the firm, to gain fast access to new technologies or new markets, to benefit from economies of scale in joint R&D and/or production and to share the risks for activities that are beyond the scope or capabilities of a single SME (Fischer and Varga, 2002). Further, innovation in the context of SMEs, generally refers to the technological capability to create a new product or modify the existing product/process for the benefit of a firm (Pagano and Schivardi, 2003). It generates absorptive capacity, which is defined as the capability to identify, assimilate, and apply knowledge (Cohen and Levinthal, 2000). The absorptive capacity has a positive relationship with the innovative potential of a firm and leads to enhanced economic performance (Kostopoulos et al., 2011; Najafi Tavani et al., 2013).

Given the role of network cooperation and innovation, it is appropriate to ascertain the importance of internationalization in the context of SMEs. It generally refers only to exports as exports are relatively faster and easier way of penetrating foreign markets with limited resources (Morgan & Katsikeas, 1997). Internationalization helps SMEs to spread their business risks, to improve technological quality, to generate more revenues and thus, lead to their better economic performance (Leonidou, 2004; Ebersberger and Herstad, 2013). Literature has identified two types of liabilities for the firms operating in the foreign market, such as liability of newness (Stinchcombe, 1965), and liability of foreignness (Hymer, 1976). The liability of newness relates with the increased cost of doing business in the foreign nation based on the new rules and regulations of the foreign land, while liability of foreignness refers to the involvement of the SME with the new government, new customers and suppliers, unfamiliarised local culture etc. which leads to a sense of discrimination towards the newly entered SME. Moreover, firms penetrating

international markets usually experience more difficulties relating to organizational and environmental complexities, which enhance governance, coordination, and transaction costs (Zaheer and Mosakowski, 1997).

It is against this background that the present study proposes to explore the relationship between network cooperation, innovation and internationalization, and their role in the context of economic performance of SMEs in the Indian context, based on empirical data. The study is structured to comprise six sections. The conceptual framework and the hypotheses (based on literature review) are proposed in section 2. Further, section 3 deals with the research methodology. Section 4 describes the analyses of objectives to derive inferences, which are discussed further in section 5. Section 6 deals with the scope for future work.

II. Conceptual Framework and Hypotheses Development

Given the relationships found in literature between network cooperation, innovation performance, internationalization performance and economic performance of SMEs, we are keen to statistically explore these relationships empirically. The hypothesized relationships are depicted in Figure 1.

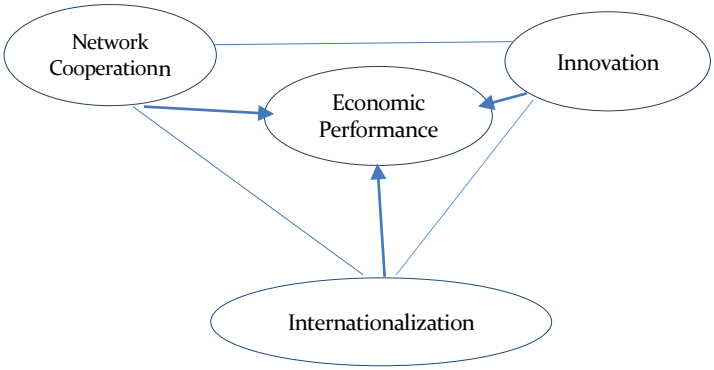

Figure 1 Network cooperation, innovation, internationalization and economic performance of SMEs

Hypothesis 1: There exists a significant relationship between network cooperation and the innovation performance of SMEs.

External network actors are the innovation intermediaries, which facilitate and coordinate innovation (Gronum et al., 2012; Nakwa et al., 2012). The network of SMEs consists of informal arrangements and formal long- term strategic alliances, which may lead to both types of technological innovation,

viz. incremental and radical (Sammarra and Biggiero, 2008). Incremental innovation, predominant in manufacturing SMEs, refers to the improvement of existing products or the modification of the process in operation, while radical innovation is referred to disruption of the status quo and lead to a new product and/or the process. Some authors present the role of SMEs as incremental innovators (Veryzer, 1998; Bala Subrahmanya, 2015), while others perceive the role of radical innovators of SMEs as more prominent (Kanter, 1985; Oke et al., 2007). But based on both arguments, it is confirmed that SMEs, in general, are innovative in nature. In line with this, SMEs form an external network and cooperate with each other to complement their capabilities and improve their skills.

Hypothesis 2: There exists a significant difference between the internationalization performance of networked SMEs, based on their degree of network cooperation.

SMEs form networks to fill their inherent gap in resources. These networks help them to attain complementary assets, either tangible or intangible and provide them a competitive advantage. The network formed by SMEs provides them several advantages compared to non-networked firms. This external network enables SMEs to acquire new technological skills and managerial know-how. More often, the small and mid-sized firms are unaware of the foreign markets where there is a significant demand of their products. This information asymmetry is resolved with network agents or intermediaries, leading to more export orientation. Eventually SMEs enter foreign markets and generate significant proportion of sales internationally. Thus, these networks are sometimes called international networks, which help the firms to expand their geographical presence.

Hypothesis 3: There exists a significant difference between internationalization performances of networked SMEs, based on their level of innovation performance.

The researcher fraternity in empirical literature has studied the relationship between innovation and internationalization. But the effect of one on the other does not suggest a unique and uniform direction of influence. There are two schools of thought investigating the relationship between these constructs. Some studies proved the causal effect of innovation on the degree of internationalization (Cassiman and Martinez-Ros, 2007), while others presented the effect of internationalization (exports and foreign collaborative arrangements) on innovation performance (Pla-Barber and Alegre, 2006; Kafouros et al., 2008; Keeble et al., 2017). There are various empirical studies which offer greater evidence that firms carrying out more innovation have a greater propensity to export and to intensify exports (Caldera, 2010; Love and

Roper, 2015, among others), though there are other studies which show the existence of bi-directional relations and which therefore support the idea that firms strengthen and learn innovation through internationalization (Girma et al., 2008; Damijan et al., 2010). But Golovko and Valentini (2011) observed complementarity between innovation and exports for SMEs' growth by examining the unbalanced panel of Spanish manufacturing firms over the period 1990–1999. In other words, the adoption of one growth strategy (e.g., entering export markets) positively influences the adoption of the other (e.g., innovation) and vice versa.

Hypothesis 4: There exist significant differences in the economic performance of SMEs, based on their degree of network cooperation.

SMEs view external partners as complimentary assets and derive the required benefits. SMEs make networks to access knowledge about new products/processes and to acquire new technical capabilities and marketing skills (Hall and Bagchi-Sen, 2007). Broadly, network cooperation includes two types of linkages, such as vertical and horizontal. The nature of cooperation is based on the objective of the host firm and actors involved in cooperation.

Vertical cooperation, which mainly includes network actors such as customers, suppliers and manufacturers, helps manufacturers to acquire sufficient knowledge about advanced technologies and new markets. Vertical linkages of SMEs with their suppliers provide valuable inputs which enable these firms to improve their manufacturing process significantly and to substitute existing raw materials in the form of new machinery or accessories, if needed (Whitley, 2002). Further, interaction with customers and clients particularly helps SMEs to know better about their product acceptability, which further helps them in product improvement.

More often, vertical cooperation exists in the form of subcontracting due to the limited exposure of SMEs in the retail segment. Lack of credibility of SMEs makes more difficult for them to cater their manufactured products directly to retail customers. Therefore, large firms deal with retail customers and subcontract their work to SMEs. In this way, subcontracting relationships between large firms and SMEs are mutually beneficial to both the market participants.

Horizontal cooperation includes SMEs of the same sector and knowledge co-operators called government institutions, industry associations and research organizations, among others. It helps the networked SMEs to perform joint R&D, which in turn helps in reducing the cost and improving the product quality. Moreover, knowledge co-operators assist SMEs by providing grants/loans, academic expertise and/or purchasing equipment for their R&D operations, among others.

Hypothesis 5: There exists significant difference in the economic performance of SMEs, based on their level of innovation performance.

Innovation refers to the technological capability to create a new product or modify the existing product/process for the benefit of a firm. Innovation helps the firm in cost reduction and quality improvement of both existing and new products (Pagano and Schivardi, 2003). SMEs are involved in the incremental innovation process since their establishment. They cannot survive in the competitive world without innovation. As both input and output indicators define innovation, we find the effect of both R&D effort and innovated sales, respectively, in empirical literature. Innovated SMEs realize a share of innovated products in their total sales, leading to a higher growth of sales turnover. There are many empirical studies across the world, which indicated a positive correlation between innovation and sales growth of SMEs. Roper (1997) based on the empirical study in Europe, found that innovation in the German, UK and Irish SMEs had a positive impact on sales turnover. Lumiste et al. (2004) observed the same relationship between innovation and firm performance in Estonian SMEs. Engel et al. (2004) found the same effect in German craft SMEs. Coad and Rao (2008) also observed that innovation leads to higher sales growth in high tech industries of the US.

Hypothesis 6: There exists significant difference in the economic performance of SMEs, based on their degree of internationalization performance. Internationalization provides SMEs the avenues for knowledge growth, capability development and revenue enhancement, which reinforce their competitiveness. There are many empirical studies that showed a positive relationship between internationalization and economic performance of SMEs. McDougall and Oviatt (1996) found that internationalization of firms had a positive effect on both market share and return on investment in the sample of 62 US firms. The results of this study indicate that the more internationalized firms have been able to improve their market share, but could not improve their profitability. Yip et al. (2000) based on 68 mid-sized United States based companies, showed that the firms that followed a systematic internationalization approach achieved significant growth. Lu and Beamish (2001) observed in the case of Japanese SMEs that exports had a positive influence on sales (growth), but had a negative implication for profitability measured in terms of returns on sales (ROS). Mlinari and Mlinari (2003) found that the degree of internationalization had a positive impact on profitability in Slovenian SMEs. Chiao et al. (2006), in their study on internationalization of SMEs of textile and electronic industries of Taiwan, found that the return on export sales was positively influenced by the internationalization of SMEs. Pangarkar (2008) also observed the same effect in the context of Singapore SMEs.

III. Empirical Methodology

1. Scope, Data Source and Survey Design

The study is confined to internationalized manufacturing SMEs of Bangalore city of Karnataka focused only on engineering goods industry and the database is obtained from Visvesvaraya Trade Promotion Centre (VTPC), the designated Nodal Agency of the Government of Karnataka for the promotion of International Trade from Karnataka. The study employs primary data collected from November 2015 to December 2016 using a semi-structured questionnaire by visiting the SMEs and conducting personal interviews with their CEOs. We followed the random sampling technique and managed to contact a total of 298 manufacturing SMEs but could obtain 117 completed questionnaires with a response rate of 39.8 %.

2. Profile of Firms

The sampling distribution of manufacturing SMEs is classified on the basis of manufactured products as shown in Table 1. It is observed that the majority of firms (35%) operated in the machine components industry followed by the electromagnetic equipment (22%) and precision components (18%). Moreover, approximately 10% of the sample consists of SMEs manufacturing fabricated metal products. Further, an equal proportion of SMEs (7.5%) constitutes those manufacturing material handling equipment and those engaged in the manufacturing of electronic products. Broadly, about 53% of the sampled SMEs fall in the category of component manufacturers (machine components and precision components together) whereas the remaining 47% SMEs manufactured end products.

Table 1 Distribution of sample firms based on type of products

Product Type	Number of Firms	Percentage Composition
Machine Components	41	35%
Electromagnetic Equipment	26	22%
Precision Components	21	18%
Fabricated Metal Products	11	10%
Material Handling Equipment	9	7.5%
Electronic Products	9	7.5%
Total	117	100%

3. Measurement of Variables

It is appropriate to empirically investigate the characteristics of network cooperation, innovation performance and internationalization performance of sampled SMEs, before examining an association between the three. Thus, the following sections describe SME characteristics with respect to their network cooperation, innovation and internationalization, respectively.

3.1 Network Characteristics

Network cooperation is measured in terms of the degree of interaction of SMEs with network participants and the quantum of assistance received by the SMEs from all network participants across different dimensions.

3.1.1 Degree of interaction with network participants

In general, SMEs tend to interact with their customers and suppliers, periodically. In addition, they may interact with their industry associations for keeping them abreast of the developments in the industry, interact with government agencies to know the policy related developments, and they may interact even with R&D organizations or universities to overcome some technical problem or the other which they encounter in their day to day operations. Some may even interact with their competitors, if situation forces, to cater to a different market jointly. These diverse interactions enable them to develop their own networks, which can be beneficial to them in various ways. Thus, the degree of network cooperation can be measured by the extent of frequency of interaction of SMEs with different network players, such as customers, suppliers, R&D organizations, universities, government ministries, government agencies, industry associations and competitors. The frequency of interaction is measured on an ordinal Likert scale of 1 to 5; those SMEs which interact with a network actor hardly once a year (beyond 12 months) are ranked the lowest (1), SMEs which interact with a network stakeholder once in 9-12 months (2), those which communicate with a network participant once in 6-9 months (3), SMEs which interact with a network actor/participant once in 3-6 months (4), and those which interact with a network player in every 3 months are given the highest rank (5).

While collecting the data pertaining to frequency of interactions in the Likert scale, it is observed that R&D organizations and universities are considered one and the same from the respondent's perspective. Moreover, government ministries and government departments (or agencies) are generally considered similar for the SMEs.

Table 2 represents the descriptive statistics of the interaction score of all the SMEs. The minimum value of interaction frequency of SMEs with suppliers and customers is 2 and 3 respectively. Moreover, the mean values of

interaction frequencies of SMEs are more than 4 for customers, are between 3 and 4 for suppliers and are in between 2 and 3 for rest of the network participants. It implies that, overall, the SMEs interact more frequently with customers and suppliers as compared to the other four network stakeholders, viz. industry associations, competitors, government agencies and R&D organizations. This is because the customers and suppliers lie at the extremities of the diameter of a network circle, without which the network length cannot be determined. In other words, suppliers provide the necessary raw material and equipment to the manufacturing SMEs, which in turn deliver the finished product to their customers. Thus, the relationship with customers and suppliers is simply unavoidable in a cooperative network model. On the other hand, every other network actor lying along the network diameter, may be avoidable at some point of time or the other. It means in general, it is not perceived essential to all SMEs to interact with other network stakeholders on a regular basis.

Table 2 Description of interaction frequency scores with network participants

Network Participants	Minimum	Maximum	Mean	Std. Deviation
Customers	3.0	5.0	4.179	.6105
Suppliers	2.0	5.0	3.171	.8739
R&D Organizations	1.0	5.0	2.855	1.1690
Industry Associations	1.0	5.0	2.846	1.1189
Government Agencies	1.0	5.0	2.692	1.1254
Competitors	1.0	4.0	2.453	.9049

Subsequently, Table 2 indicates that the other three network stakeholders, such as industry associations, government agencies and R&D organizations are interacted alike by the SMEs, as indicated by their mean values of network frequency. These three network actors act only as knowledge intermediaries (co-operators) for the SMEs. Further, the SMEs interact the least with their competitors, as indicated by the mean and the maximum score of interaction frequencies. It could be due to the insecurity imbibed in the CEOs while partnering with the same sector firms. It is observed that the CEOs of SMEs are reluctant to share ideas and exchange knowledge with each other.

3.1.2 Extent of assistance received from network participants

SMEs, in general, receive different kinds of assistance from the external network participants relating to marketing, tax and legal matters, among others. The extent of assistance received by our sample SMEs is captured on an

ordinal Likert scale of 1 to 5 and the same is presented in Table 3 comprising minimum, maximum, mean and standard deviation values.

Out of the total 19 assistance variables, for 14 assistance variables the maximum value was 5. Among another four variables, the maximum value was 4, whereas for one variable (training courses for entrepreneurs) the maximum value for the degree of assistance received was only 3. Further, out of the total 19 variables, for 10 variables the minimum value for the degree of assistance received was 1. For another eight variables the minimum value was 2, whereas for the remaining variable (product specification), the minimum value was 3, which had the maximum value of 5 as well. This implies that SMEs resort to external interactions the most for product specifications more than anything else.

Table 3 Descriptive statistics of network assistance

Assistance Variables	Minimum	Maximum	Mean	Std. Deviation
Product Specification	3.0	5.0	3.897	.6350
Raw Material Selection	2.0	5.0	3.880	.7447
Product Feedback	2.0	5.0	3.846	.6774
Updating Manufacturing Process	2.0	5.0	3.615	.7862
Quality Control Systems	1.0	5.0	3.590	.8423
Market Awareness	2.0	5.0	3.299	.6981
New idea/ product or technology	2.0	5.0	3.248	.7532
Advanced Order Information	2.0	5.0	3.171	.6603
Machinery & Equipment	2.0	4.0	3.077	.6842
Lobbying & Mediating	1.0	5.0	3.060	.8018
R&D Infrastructure	2.0	5.0	2.932	.7396
Knowledge Exchange	1.0	5.0	2.778	.8621
Researcher Expertise	1.0	4.0	2.761	.6110
New Market Avenues for Common Product	1.0	5.0	2.735	.8847
Policy Framework	1.0	5.0	2.667	.9649
Resource Sharing	1.0	5.0	2.581	.8534
Tax and Legal Matters	1.0	4.0	2.342	.7211
Training Courses for Entrepreneurs	1.0	3.0	2.274	.5190
Subsidies & Tax Incentives	1.0	4.0	1.983	.6430

Further, product feedback, new idea/product/technology, raw material selection, advanced order information, updating manufacturing process, market awareness and R&D infrastructure are the other variables/dimensions for which SMEs resort to external interactions. Knowledge exchange, new market venues, resource sharing, lobbying and mediating, quality control systems and policy framework are the other but less important prompting factors for external interactions. Among all, research expertise, tax and legal matters, and subsidies and tax incentives are the least prompting factors for external interactions.

Given the distribution of varying factors of network assistance, it is important to understand the distribution of these SMEs in terms of the intensity of network interactions. Therefore, we have summed up the scores of each SME for the degree of assistance of network cooperation that they have established in terms of 19 variables and classified them broadly into three groups, namely, (i) low degree of network cooperation; (ii) medium degree of network cooperation and (iii) high degree of network cooperation (Table 4). In this process, we calculated the values of the variable (total assistance score) corresponding to 33 percentile, 66 percentile and then 100 percentile to divide it into three categories, such as low, medium and high network cooperation.

As revealed in Table 4, our sample SMEs is more or less even distributed between the three groups. While 34% (40 SMEs) claimed to have a high degree of network cooperation, another 29% (34 SMEs) accounted for medium degree of network cooperation, whereas the remaining 37% (43 SMEs) accounted for low degree of network cooperation.

Table 4 Distribution of firms based on the degree of network assistance

Network Assistance	Number of SMEs	Percent
Low	43	37
Medium	34	29
High	40	34
Total	117	100

Given the degree of network cooperation of SMEs, it is appropriate to know their innovation dimensions.

3.2 Innovation Characteristics

We have tried to ascertain the innovation dimensions of SMEs under four broad categories, namely, (i) New materials used in Production Process, (ii) Improvements made in production process, (iii) Modified Product Sales Proportion and (iv) New Product Sales Proportion. The descriptive statistics

comprising values for minimum, maximum, mean and standard deviation for these four types of innovation are presented in Table 5.

Overall, among the four types of SME innovations, modified product sales accounted for the highest mean values followed by new production process, improved production process and new product sales. This implies that SME innovations are largely characterized by incremental innovations in the form of modified products and improved process, followed by radical innovations in the form of new process and new products. Other things remaining the same, the constant interactions that these SMEs have with customers and suppliers would have prompted them to involve more in incremental innovations than in radical innovations.

Table 5 Descriptive statistics of innovation variables

Innovation Variables	Min	Max	Mean	Std. Deviation
New materials used in Production Process	2	5	2.91	.788
Improvements made in production process	2	5	2.90	.770
Modified Product Sales Proportion	2	5	3.03	.830
New Product Sales Proportion	1	5	2.590	.9112

Given the understanding of the importance of types of SME innovations, it is appropriate to know their distribution in terms of the degree of innovation performance. This is arrived at by summing up the values of four types of innovations for each of the SMEs. We have divided the SMEs broadly into three groups, namely (i) high degree of innovation performance; (ii) medium degree of innovation performance and (iii) low degree of innovation performance. The SMEs are more or less evenly distributed between three groups as revealed in Table 6. About one-third of SMEs accounted for high degree of innovation performance, another nearly one-third accounted for medium degree of innovation performance and about 35% of them accounted for low degree of innovation performance.

Table 6 Distribution of firms based on the degree of innovation performance

Innovation Performance	Number of SMEs	Percent
Low	41	35
Medium	37	31.5
High	39	33.5
Total	117	100.0

Internationalization characteristics

After the understanding of the extent of network cooperation and innovation of our sample SMEs, an understanding of their internationalization performance is appropriate. The internationalization performance of SMEs is represented by their export intensity, export speed and export scope. Table 7 presents the descriptive statistics of internationalization characteristics in terms of these three dimensions. At the outset, it is observed that both standard deviation and range of all the three variables pertaining to internationalization performance are very high, which indicate considerable differences in the international orientation of the sample SMEs. Generally, the mean number of countries penetrated by the SMEs in the study is observed to be 5 to 6, despite its range varying from 1 to 27. Also the average time taken to initiate exports since their establishment is 10 years, though some SMEs are born exporters whereas, some others took more than 3 decades to initiate their exports. Moreover, the mean proportion of export sales is approximately 30%, although the export sales range between 10% and 70%.

Table 7 Descriptive statistics of internationalization variables

Internationalization Variables	Minimum	Maximum	Mean	Std. Deviation
Export Scope	1	27	5.57	5.031
Export Speed	0	34	10.12	6.961
Export Intensity	10.0	70.0	29.786	12.9554

IV. Data Analysis and Hypothesis Testing

Now, after getting insights into the characteristics of network cooperation, innovation performance and internationalization performance of sample SMEs through an empirical investigation, it is pertinent to test the bivariate relationships between network cooperation and innovation (Hypothesis 1), between network cooperation and internationalization (Hypothesis 2), and between innovation and internationalization (Hypothesis 3), respectively. Moreover, the relationships between network cooperation and economic performance (Hypothesis 4), between innovation and economic performance (Hypothesis 5) and between internationalization and economic performance (Hypothesis 6) are tested using appropriate statistical techniques.

1. Testing Hypothesis 1: Network Cooperation and Innovation Performance

To ascertain the relationship between network cooperation (network assistance) and innovation performance of SMEs, we use chi-square statistical technique. Chi-square test of independence is used to probe an association between two categorical variables. The test is performed only after depicting the contingency table of both categorical variables across defined levels. If the value of expected count satisfies the conditions of the given contingency table, the results of chi-square test are reliable. In our contingency Table 8, the minimum expected count is found to be 10.8, which is above the threshold value of 5 recommended for 3*3 contingency tables.

Table 8 Contingency table: network assistance and innovation performance

			Innovation Performance			Total
			Low	Medium	High	
Network Assistance	Low	Count	28	11	4	43
	Medium	Count	8	14	12	34
	High	Count	5	12	23	40
Total		Count	41	37	39	117

Further, it is observed in Table 8 that the maximum number of SMEs (28) have both low levels of network assistance and innovation performance, followed by the number of SMEs (23) having both high levels of network assistance and innovation performance. Subsequently, it is confirmed that the chi-square tests of independence are found to be statistically significant as observed in Table 9, which implies that network assistance and innovation performance are not independent of each other.

Table 9 Chi-square results for network assistance and innovation performance

	Value	df	p-value
Pearson Chi-Square	34.193	4	.000
Likelihood Ratio	35.719	4	.000
Linear-by-Linear Association	30.783	1	.000

Further, the strength of the relationship is tested using Cramer's V value. Cramer's V value of less than 0.2 indicates weak relationship, between 0.2 and

0.3 indicates moderate and above 0.3 means strong relationship. Here, Cramer's V value is found to be 0.382, which indicates a strong relationship between network assistance and the innovation performance of SMEs.

2. Testing Hypothesis 2: Network Cooperation and Internationalization Performance

Network cooperation is a categorical variable having 3 categories; low, medium and high, whereas, all the three variables measuring internationalization performance are continuous in nature. Therefore, we use ANOVA to probe the differential impact of the 3 categories of network cooperation on all the variables of internationalization performance. Since ANOVA is robust to the violation of normality, we ignore the normality assumption for variables of internationalization performance across all the three categories of network cooperation. Moreover, since we have only three categories of network cooperation, we get the same results even with Kruskal Wallis test (non-parametric ANOVA).

Now, we have 3 variables of international performance, viz. export intensity, export scope, and export speed. Therefore 3 hypotheses are formulated as follows:

- Hypothesis 2 (a): There exists a significant difference between export intensities of networked SMEs, based on their degree of network cooperation.
- Hypothesis 2 (b): There exists a significant difference between export scopes of networked SMEs, based on their degree of network cooperation.
- Hypothesis 2 (c): There exists a significant difference between export speeds of networked SMEs, based on their degree of network cooperation.

All the above three hypotheses are tested subsequently.

2.1 One-Way ANOVA Model to Test Hypothesis 2(a)

In this section, we probe the difference in the export intensities of SMEs based on the degree of assistance received from an external network. Export intensity is the dependent variable.

The primary assumption to conduct ANOVA is the homogeneity of variance in the dependent variable across different categories.

Since the Levene test (Levene statistic=7.483) for equality of variances is found to be significant (with p –value=0.001), we conduct Brown-forsythe and Welch tests for the equality of means of export intensities of SMEs based on the degree of network cooperation, as shown in Table 10.

Table 10 Robust tests of equality of means for export intensity across levels of network cooperation

Export Intensity	Statistic	df1	df2	p-value
Welch	16.823	2	68.502	.000
Brown-Forsythe	19.338	2	90.925	.000

Brown-forsythe and Welch tests are found to be significant at 99% confidence interval. Therefore, we conclude that there exists a significant difference in the export intensities of SMEs based on the degree of their network cooperation. Now, to identify those groups having significant difference in their export intensities, further analysis is required.

Post-hoc multiple comparisons can be done using various tests, depending on the presence/absence of variance in the dependent variable across different categories. Here, we have heteroscedasticity in the data for which we can use Games-Howell Test or Dunnett's Test.

Table 11 Post-hoc multiple comparisons using Games-Howell test for export intensity across levels of network assistance

TotAssist(I)	TotAssist(J)	Mean Difference (I-J)	Std. Error	p-value
Low	Medium	-4.2750	2.1463	.123
	High	-15.1279*	2.6059	.000
Medium	Low	4.2750	2.1463	.123
	High	-10.8529*	2.9212	.001
High	Low	15.1279*	2.6059	.000
	Medium	10.8529*	2.9212	.001

Note: The mean difference is significant at the 0.05 level.

We have used Games-Howell Test. It is a post-hoc test performed in conjunction with ANOVA to compare the means of all possible groups, when heteroscedasticity is observed in the dependent variable. It is a multiple comparison test used to ascertain the statistical difference in the means of observed groups. It is observed in Table 11 that out of three groups, only two groups have statistically significant differences. The export sales of highly-networked SMEs is significantly different from both export sales of moderately networked SMEs and that of low networked SMEs. But the export sales of medium-networked and low-networked SMEs are not statistically different from each other.

2.2. One-Way ANOVA Model to Test Hypothesis 2(b)

In this section, we probe the difference in the export scopes of SMEs based on the degree of assistance received from an external network. Here, export scope is the dependent variable. The Levene test (Levene statistic=0.920) for equality of variances is found to be insignificant (with p –value=0.401), therefore the homogeneity of variance assumption is met for conducting ANOVA.

The result observed in Table 12 indicates that the model is not significant. Thus, we do not find any significant differences in the export scope of SMEs, based on their level of network assistance. It implies that the number of countries penetrated by SMEs is not related with the degree of network assistance received by them.

Table 12 One-Way ANOVA table for export scope

	Sum of Squares	Df	Mean Square	F	p-value
Between Groups	38.422	2	19.211	.756	.472
Within Groups	2898.210	114	25.423		
Total	2936.632	116			

2.3. One-Way ANOVA Model to Test Hypothesis 2(c)

In this section, we probe the difference in the export speeds of SMEs based on the degree of assistance received from an external network. Here, export speed is the dependent variable. The Levene statistic (Levene value=1.776) for equality of variances is found to be insignificant (with p –value=0.174), therefore the homogeneity of variance assumption is met for conducting ANOVA.

Table 13 One-Way ANOVA for export speed

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	5.430	2	2.715	.055	.946
Within Groups	5614.894	114	49.253		
Total	5620.325	116			

The result indicates that the model is not significant, as reflected in Table 13. Therefore, we do not find any significant difference in the export speed of SMEs, based on their level of network assistance.

Therefore, we have seen that the export speed and export scope of SMEs are independent of the networking capability of SMEs whereas the export intensity of SMEs is associated with the degree of network cooperation (or assistance) of SMEs.

3. Testing Hypothesis 3: Innovation Performance and Internationalization Performance

Innovation performance is a categorical variable having three categories: low, medium and high. On the other hand, all the three variables measuring internationalization performance are continuous in nature. Thus, we use ANOVA to probe the differential impact of the three categories of innovation performance on all the variables of internationalization performance, viz. export intensity, export scope, and export speed. The three hypotheses are formulated as follows.

- Hypothesis 3 (a): There exists a significant difference between export intensities of networked SMEs, based on their level of innovation performance.
- Hypothesis 3 (b): There exists a significant difference between export scopes of networked SMEs, based on their level of innovation performance.
- Hypothesis 3 (c): There exists a significant difference between export speeds of networked SMEs, based on their level of innovation performance.

3.1. One-Way ANOVA Model to Test Hypothesis 3(a)

In this section, we probe the difference in the export intensities of SMEs based on the degree of their innovation performance. Export intensity is the dependent variable. The Levene test (Levene statistic=5.322) for equality of variances is found to be significant (with p–value=0.006), which indicates the presence of heteroscedasticity in the dependent variable across different categories. Hence, we conduct Brown-forsythe and Welch tests for the equality of means. It is observed that both non-parametric test results are found to be significant, as observed in Table 14. Hence, it is appropriate to conclude that there exist significant differences in the export intensities of SMEs, based on their degree of innovation performance.

Table 14 Robust tests of equality of means for export intensity across categories of innovation performance

Export Intensity	Statistic	df1	df2	p-value
Welch	27.835	2	73.359	.000
Brown-Forsythe	30.933	2	91.975	.000

Now, to identify those groups having significant difference in their export intensities, post-hoc multiple comparison tests are done using Games-Howell Test.

Table 15 Post-hoc multiple comparisons using Games-Howell test for export intensity across categories of innovation performance

(I) INNPERF	INNPERF(J)	Mean Difference (I-J)	Std. Error	p-value
Low	Medium	-8.7409*	1.9299	.000
	High	-18.5053*	2.5676	.000
Medium	Low	8.7409*	1.9299	.000
	High	-9.7644*	2.5934	.001
High	Low	18.5053*	2.5676	.000
	Medium	9.7644*	2.5934	.001

Note: The mean difference is significant at the 0.05 level.

It is observed in Table 15 that there exists a statistical difference between the export intensities of SMEs across all the three categories of innovation performance. It implies that the SMEs exhibiting higher innovation performance have more export intensity than that of moderately innovative and that of low innovative SMEs.

3.2. One-Way ANOVA Model to Test Hypothesis 3(b)

In this section, we probe the difference in the export scopes of SMEs based on their degree of innovation performance. Export scope is the dependent variable. The Levene test (levene statistic=2.560) for equality of variances is found to be insignificant (with p –value=0.082), therefore the homogeneity of variance assumption is met for conducting ANOVA.

Table 16 One-Way ANOVA for export scope across categories of innovation performance

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	43.145	2	21.572	.850	.430
Within Groups	2893.488	114	25.381		
Total	2936.632	116			

Table 16 indicates that the model is not significant as p-value is found to be 0.43. Therefore, we do not find any significant difference in the export scopes of SMEs, based on their level of innovation performance.

3.3. One-Way ANOVA Model to Test Hypothesis 3(c)

In this section, we probe the difference in the export speeds of SMEs based on the degree of their innovation performance. Export speed is the dependent variable. The Levene statistic (value=0.066) for equality of variances is found to be insignificant (with p–value=0.937), therefore the homogeneity of variance assumption is met for conducting ANOVA.

Table 17 indicates that the model is not significant as the p-value is greater than 0.05. Therefore, we do not find any significant difference in the export speed of SMEs, based on their level of innovation performance.

Table 17 One-Way ANOVA for export speed across categories of innovation performance

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	114.643	2	57.321	1.187	.309
Within Groups	5505.682	114	48.295		
Total	5620.325	116			

Overall, it is concluded that the export speed and export scope of SMEs are independent of the innovation performance of SMEs. Only the export intensity of SMEs gets influenced or influences the innovation performance of SMEs.

After probing the relationships between network cooperation, innovation performance and internationalization performance of SMEs using preliminary analysis, it is appropriate to ascertain the relationships of the three with the economic performance of SMEs, which is described in the following section.

4. SMEs and Economic Performance

SMEs form external network linkages to complement their skills, knowledge and resources. They perform different types of innovation and penetrate their products in international markets in order to enhance their economic performance. Therefore, we are interested to ascertain the pair-wise relationships of these constructs with the economic performance (sales turnover) of SMEs.

4.1 Testing Hypothesis 4: Network Cooperation and Economic Performance

Network cooperation is a categorical variable having 3 categories low, medium and high. On the other hand, economic performance is a continuous variable measured by the sales turnover of SMEs in the year 2015-16. Therefore we use ANOVA to probe the differential impact of the three categories of network cooperation on the sales turnover of SMEs. The formulated hypothesis for the model is that there exists a significant difference between the sales of networked SMEs, based on their degree of network cooperation.The Levene statistic (value =4.460) for equality of variances is found to be significant (with p–value=0.014). Thus, we conduct Brown-forsythe and Welch tests for the equality of means. It is observed in Table 18 that both non-parametric test results are found to be significant. Hence, there exist significant differences in the sales turnover of SMEs, based on their degree of network cooperation.

Table 18 Robust tests of equality of means for sales turnover across categories of network cooperation

Sales Turnover	Statistic	df1	df2	p-value
Welch	28.076	2	73.216	.000
Brown-Forsythe	33.477	2	100.862	.000

Now, to identify those groups of SMEs having significant difference in their sales turnover, post-hoc multiple comparison tests are done using Games-Howell Test. It can be observed from Table 19 that there exists a statistically significant difference between the sales of SMEs across all the three categories of network cooperation. It implies that the SMEs receiving higher network assistance have better economic performance than that of medium-networked SMEs or low-networked SMEs.

Table 19 Post-hoc multiple comparisons using Games-Howell test for sales turnover across categories of network cooperation

(I)TOTASSIST	TOTASSIST(J)	Mean Difference (I-J)	Std. Error	p-value
Low	Medium	-.9015*	.3145	.015
	High	-2.8221*	.3749	.000
Medium	Low	.9015*	.3145	.015
	High	-1.9206*	.3912	.000
High	Low	2.8221*	.3749	.000
	Medium	1.9206*	.3912	.000

Note: The mean difference is significant at the 0.05 level.

4.2 Testing Hypothesis 5: Innovation Performance and Economic Performance

Innovation performance is a categorical variable having 3 categories low, medium and high. On the other hand, economic performance is a continuous variable measured by the sales turnover of SMEs. Thus, we use ANOVA to probe the differential impact of the 3 categories of innovation performance on the sales turnover of SMEs. The formulated hypothesis for the model is that there exists a significant difference between sales of networked SMEs, based on their degree of innovation performance. The Levene statistic (value=1.002) for equality of variances is found to be insignificant (with p–value=0.370), thus the homogeneity of variance assumption is met for conducting ANOVA. Table 20 indicates that the model is significant. Thus, there exists significant difference in the economic performance (sales turnover) of SMEs, based on their level of innovation performance.

Table 20 One-Way ANOVA for sales turnover across categories of innovation performance

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	171.821	2	85.911	33.689	.000
Within Groups	290.709	114	2.550		
Total	462.530	116			

Table 21 Post-hoc multiple comparisons using Tukey's HSD test for sales turnover across categories of innovation performance

(I)TOTASSIST	TOTASSIST(J)	Mean Difference (I-J)	Std. Error	p-value
Low	Medium	-1.0336*	.3621	.014
	High	-2.9006*	.3572	.000
Medium	Low	1.0336*	.3621	.014
	High	-1.8669*	.3665	.000
High	Low	2.9006*	.3572	.000
	Medium	1.8669*	.3665	.000

Now, to identify those groups having significant difference in their sales turnover, post-hoc multiple comparisons are done using Tukey's HSD (honest significant difference) test. Tukey's HSD is a post-hoc test performed after ANOVA to compare the means of all possible groups, when the equality of variance is observed in the dependent variable. It is a multiple comparison test

used to ascertain whether there exists a statistically significant difference in the means of observed groups.

Table 21 reveals that there exists a statistically significant difference between the sales of SMEs across all the three categories of innovation performance. It implies that the highly innovative SMEs have the highest sales followed by the medium level and low innovative firms, respectively.

4.3 Testing Hypothesis 6: Internationalization Performance and Sales Turnover

Since both sales turnover and variables measuring internationalization performance are continuous in nature, correlation analysis is used to investigate the association between them. It is found in Table 22 that only export intensity has a significant positive association with the sales turnover of SMEs. It means export sales and economic performance is positively correlated implying that higher export sales is accompanied by higher economic performance and vice versa. But, the other variables, viz. export scope and export speed do not have any statistically significant relationship with the economic performance of SMEs.

Table 22 Correlation: internationalization performance and sales turnover

Variables	Export Scope	Export Speed	Export Intensity	Current Sales Turnover
Export Scope	1			
Export Speed	-.124	1		
Export Intensity	.110	.018	1	
Current Sales Turnover	.119	-.065	.600**	1

Note: Correlation is significant at the 0.01 level (2-tailed)

V. Discussion of Findings

With respect to network characteristics, it is observed that SMEs interact the most with customers and suppliers, and receive the maximum assistance in the realm of product specifications, whereas they interact the least for entrepreneurial training and issues relating to subsidy and tax incentives. Further, with respect to innovation characteristics it is observed that SMEs do not resort to manufacturing new products as much as they resort to product modifications or process improvements or even to the introduction of new raw materials. Subsequently, with respect to internationalization characteristics, it

is observed that the mean proportion of exports in total sales of SMEs is approximately 30%, which denotes a moderate share of exports in the total sales turnover of SMEs.

The examination of bivariate (pairwise) relationships revealed that there exists a positive relationship between network assistance and innovation performance of SMEs. It implies that higher the network assistance received from an external network, greater is the innovation performance of SMEs. Further, while investigating the relationship between internationalization performance and network cooperation, it is observed that export speed and export scope of SMEs are independent of the networking capability of SMEs, while export intensity of SMEs has a significant positive association with the degree of their network cooperation (or assistance).

Similarly, while probing the relationship between innovation performance and internationalization performance of SMEs, there exists a statistically significant difference between the export intensities of SMEs across all the three categories of innovation performance. It implies that the SMEs exhibiting higher innovation performance have more export intensity than that of moderately innovative or low-innovative SMEs. On the other hand, export speed and export scope of SMEs are independent of the innovation performance of SMEs. After probing the relationships between network assistance, innovation and internationalization, we inquired their association with the economic performance (sales turnover) of SMEs individually.

It is observed that there exists a statistically significant positive difference between the sales turnover of SMEs across all the three categories of network cooperation and of innovation performance respectively. It implies that the SMEs receiving higher network assistance exhibit better economic performance than that of medium-networked or low-networked SMEs. Similarly, the highly innovative SMEs generate the highest sales followed by the moderately innovative and low innovative SMEs.

But among the variables of internationalization performance, it is found that only export intensity has a significant positive association with the sales turnover of SMEs. It means higher the ratio of export sales of an SME, better is its economic performance. But, the other variables, viz. export scope and export speed did not have any relationship with the economic performance of SMEs.

VI. Limitation and Scope for Future Research

Firstly, our study was confined to engineering goods industry of Bangalore, Karnataka. But we cannot generalize our observations based on a particular

sector or a city. Another limitation was the small sample size. We could arrive at a sample of 117 manufacturing SME exporters of Bangalore. We can validate our results with a larger dataset spanning across more industries to generalize our research findings. Moreover, the study used cross-sectional research design. Future studies could employ longitudinal research design to gather the panel data (or time series data) for the same SMEs for a longer time period, which may bring more clarity and pattern in measuring the variables.

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