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The Impact of Supply Chain Management and Information Systems on Operational Performance: Empirical Evidence from SMEs in Saudi Arabia

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Abstarct - The study entails impact on operational performance (OPER) of small and medium size enterprises (SMEs) by using supply chain management (SCM) and information system (IS) practices in Saudia Arabia empirically. Moderation investigation of Supply Chain Management and Information System link promoted factors and impeding factors in implementing Supply Chain Management and Information System applies and OPER also taken in to account in the second part of the research. In the current study, underlying dimensions of SCM and IS practices are also empirically identified, and enabling and inhibiting fators related to SCM-IS are also identified at the first stage. Regression analysis was used for estimation of studying impact of variables on OPER and SMEs in the second phase of the research. Comparative results discussion have taken place in Saudi context at the end of the research. The study significantly contribute while considering and evaluating literature, acquire and analyses of collected data about Supply Chain Management and Information System implementations in Saudi Small and Medium Enterprices.

Keywords: Operational Performance, SMEs, Supply Chian Management, Information System, Saudi Arabia

1. Introduction

 [1] postulated challanges faced by small and medium sized enterprises for gaining sustainable competitive advantages. These challanges include intensified global competition, structural and contextual disadvantages have been faced by developed coutntries. Small and Medium (SMEs) of Saudi's have been identified in current research to analyse sustained competitive advantage. Effective supply chain management of business in rapidly changing environment contributes to survival and success of business [2]. [3] claims that companies need to develop and adopt innovative strategies for supply chain domain to gain success. Thus, performance can be achieved while managing effective supply chain as it is observed that SMEs are embedded in larger supply chain in reality [4]. In highly competitive environment it is

necessary to share required information across the linked suppliers. Availbility of latest Information Systems (IS) and technologies contribute to desiminate the required amount of information in less time includeing suppliers to customers by integrating all business processess effectively. Therefore, long-term success role is being played by the information system and supply chain management for SMEs. Small and Medium sized companies played pivotal role in the output, employment generation and in economic development by implementing technological advancements in function of SCM and enhance performing towards objetives [5].

SMEs are different in comparison of large companies in different aspectes such as resource deployment, competitive basis, approaches to information system utilization and information system practices for effective supply chain management. Information system implementation for supply chain management is necessary to understand and contextualised to gain success in business as different realities has revelead. Moreover, effects of supply chain management and information system practices on operational performance of SMEs has been idiosycrasies by evolving countries involve related factors exploration. However, [3] stated that few researches have been conducted research related to supply chain management and information systems practices and thier effects on performance of SMEs. Researchers have identified that there are various promoting and impeding factors are uncovered which are related to the SCM and IS practices and their effect on performance of organization in emerging economies. Relationship between supply chain management and information system and their effect on performance can not be defined and fully understood unless identification of encouraging and impeding external factors in specific country setting has been accomplished. Beside, availbility of knowledge about SMEs' behaviors in Saudi Arabia among vital players are still lagging behing in implemention of actual practices of under discussion issue [6]. Supply chain management and information system practices are bounded together structurally and contextually as well; the supply chain management and information systems' execution and management of these systems in business processess

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vary from country to country. Effective implementation and management of SCM and IS depends on characteristics of specific country [7]. Two neighbouring countries Turkey and Bulgaria in Southeast Europe seems to be interesting and relevant research for examinig SMEs implementation in these emerging countries. These two southeast european countries are close to larger market as they have opportunities to set up production base with potential nearby countries for market expansion [8], [9].

The primary purpose of the current study is to examine the effect on performance of small and medium enterprices by utilization of supply chain management and information system's implementation in Saudi Arabia, the promoting and impeding factor are also incorporated in the study on SME's sector of Saudi Arabia. Primarily, Identification of underlying SCM's dimensions and IS practices are evaluated at the earlier stage and associated promoted factors of supply chain & information system and inhibtors along. In the second phase consist on development and testing of hypotheses and compartive results are discussed with in specified contexts of SMEs from different countries. The impact of supply chain management and information system's practices along promoting and impeding factors for their implementation in Saudi context has been offered in curret study as depending on data provided by SME's executives. As the area under discussion has grabbed little attention of researchers in relevant context, the current paper presents the little research on supply chain management and information system usage comparatively. As placed by [10], much research on SCM-IS issue has been conducted on signle country of Southeast Europe [11]. In next phases of the paper relevant literature and hypotheses devlopment is represented followed by research methods further, discussion about results are given. At the end of this research limitation and conclusion is presented.

2. Literature Review

2.1 SCM practices

A cohesive business model which integrates suppliers, manufacturers, distributors and customers under a particualr approach and practice in effective manners which contirbute to imporve performance of individual firm and supply chain together defined as Supply Chain Management. [12], [13]. Inefficiencies associated with supply chain are targets of Supply Chain Management, while considering the anticipated customer demand. Allocation and utilization of resources to fulfill this demand effectively through materrial management, information processing, and financial management are the core values of supply chain management system. The literature provides full sence of SCM practices and its dimensions from various perspectives [14], but there is lack of consent on constructs [15]. Measurement instrument has been developed for SCM practics by [16]. Measurement scale incldues six dimension named as strategic

partnership with suppliers, relations with customers, information sharing, quality of information, internally adopted practices and post-ponement. [17] combined the suggested constructs by [18] while offering the dimensions including results of business, improvements in operations, relations of firms (internal/external), organizational leadership, management of logistics and information system processes. Researchers have discussed dimensions of supply chain management practices in smalle and medium enterprices of Turkey and their effect on performance. Outsource for meeting internal and external challanges, approaching various suppliers, long-term collaborative strategy and lean practices have been empirically tested and validated by [7] tewelve individual SCM practices as clustered. Following set of SCM practices have been identified and discussed. These 02 supply chain management practices include: long-term partnership of organization with its internal and external stakeholder such as suppliers/customers denotes long-term collaboration and deep involovement with suppliers and buyers which are source of competitive advantage in rapidly changing enviornment [16]. Availibility of right items, in right quantity at right time and timely supply to manufacturers from suppliers on consistent basis describes as Just-In-Time (JIT) technique. Performance of manufacturer to manufacture and deliver goods on time depends upon the timely and accurate availbility of raw material from suppliers [19]. Just-in-time availbility of raw material from suppliers plays vital role in success of organization in competitive enviornment [20]. Majority of the business' success depends upon the availbility of raw material from their suppliers on right time at right place [21]. Online purchasing reduces the cost for organization to purchase various demanded items as it is refered as Electronic procurement (e-procurement) as virtual purchasing system application [22]. Organizations consider differnt measures to reduce cost and effective utilization of resources to gain competitive advantage, focus on core activities and utilization of resources on core activities is the primary task. Outsourcing helps organization to free their resources from non-core activities and enable organization to focus on core activities to increase advantage in competition [23]. Another popular SCM practice known as third-party-logistics becoming important among various businesses [24], which outsource operataional logistics from external party to provide all transportation services [25]. Functional areas of business requires effecive strategic planning to offer superior customer service while keeping the cost low. Concentrating on developing and deploying strategies for sourcing, efficient supply chain, quality, reductio in total cycle time, after sale services and responsive to customer needs requires effective strategic planning [26]. Multiple sourcing is also effecitve strategy to reduce the cost of raw material and to acquire quality raw material from suppliers. Strategy helps orgnization to use multiple suppliers for their input raw material on competitive basis, this strategy enables to buy

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from specfic supplier on bargaining for lower price and better quality. Utilization of few supplier or only one supplier for raw material referes as selective sourcing [27], the purpose is to establish strategically relational and collaborative business by dedicating few specific suppliers for raw material to reduce transaction and production cost. During business transactions and in turbulant environment most of the times business operations has to face uncertainties to maintain their stock and supplies. Holding safety stock, is a practice which helps organization to maintain its demanded supplies to ucertainties tackling [28], the negative cost may occur by adopting this strategy.

2.2   IS Practices

Inbound logistics to outbound logistics, all the activites through out the production cycle, requires effective management. Production source, planning for supplies, networks of distribution and optimization across organization are tackle by Supply Chain Management. Information flow efficiency is necessary for various activities of organization to manage supply chain, which is not possible with out information system implementation. On the other hand, ineffective information system considered as hazards to effectiveness to supply chain management [29].

Information management system's capability is to dessiminate information at right time at right place to manage supply chain actvities to gain competitive advantage. Supply chain performance majorly depends upon the information system and its supply of accurate and timely information porcessing [5]. Information system practices are being used to gain competitive advantage by most of the manufacturers to enhance thier operations. Various information systems are in used named as Material Requirements Planning (MRP), Manufacturing Resource Planning (MRP-II), Enterprise Resource Planning (ERP), Supplier Relationship Management (SRM) and Customer Relationship Management (CRM) to enhance efficiency in the supply chain [30]. Differnet IS practices have its own specfic goals and benefits as the current research through light on practices of information system. Manufacturing and control systems are used for coordination between supplier and order by firm and its fulfillment by comparing the materials and availbility of resources related to market demand carry out by MRP and MRP-II. MRP and MRP-II were extended and ERP system came into existance as an integrated application. The purpose of development fulfilled infromation fragmentation across the firm to integration intra/inter-organizational information management system [31], as unified system for firm wide information managing system. Evaluation of suppliers in-line with business strategy to access the capability a systematic techinqe SRM is used by firms. Customer relationship management is curcial for business success from marketing perspective to enhance the value. CRM helps firms to integrate customers in the system to approach, collaborate and feedback from customers to gain competitive advantage.

Improvement in OPER of firms can be achieved by utilization of these e-technologies in effective customer relationship management, information and order processing from customers and security of financial transactions as well as system security. Object counting and location identification can be done through implementation of RFID tags, which helps firms to imporve their efficiency [32]. Various benefits can be achieved by implemantaion of Electronic Data Interchange (EDI), such as quality of information processing, reduction in transaction cost, reduction in level of inventory, accuracy in forecasting, improvement in cash flow and finally operational efficiency and customer service [33]. The compextiy faced during the implementation of these systems are considered as barriers and readiness of organizations [33], SMEs are provided an opportunity to gain high level of OPER by implementation of EDI and IS technologies.

2.3. SCM–IS enablers and inhibitors

The current study focus on the direction of the relationship of supply chain management & information systems' practices in positive association of OPER of small and medium enterprices seems to be improbable across all firms universally. Thus, nexus of relationship is being examined between supply chain management & information systems' practices of Saudi's smalle and medium enterprices which involve accounting for contingencies and boudnary conditionally relationship. Specifically, effects of supply chain management & information system's practices are not complete without identification and analysis of enablers and inhibtors. SCM-IS enablers are considered to be the factors which are contributing towards achievements of implementation of system while enhancing the performance. The current study identify the enablers specifically with institutional regard and socio economic landscape of rapidly developing countries. Educational and financial supports are required to gain benefit related to increase employement opportuniteis and utilization of IS practices. Specific skills and training of individual employees are required to implement and useage of highly technical system of IS to gain maximum efficiency and benefits. SMEs may not have sufficient resources to attain know-how of systm and resources required to use the system efficiently. Empowering firms by providing alternative methods of funding for example Government assistance, source of academic initiative and research center can be acquired by firms to gain maximum benefits of IS.

Similarly, lack of convenient approach to vocational / professional education is also problematic factor for SMEs [34]. Workforce from Saudi SMEs may lack in capability of utilizing latest technological equipment to perform their job tasks. Vocational training to workforce can overcome the shortcomming in skill set

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of individuals will help Saudi SMEs to deliver thier task effective utilization of SCM and IS in SMEs of Sadui firms. So that, SCM-IS enablers can be grouped together to shape the link between technological practices and OPER of Saudi SMEs. Particularly, in Saudi SMEs there is lack of information system appropriateness to improve the performance of operations in SMEs. Affordability is also an issue of Saudi SMEs to participate in industrial exibitions and fairs to gain up-to-date information about latest IS practices.

However, effective utilization of supply chain management and information system's practices enabel Saudi Small and Medium Enterprises to realise advancements in operational activities can be accessed by enhanced information system delivery [5]. Enhancing corss country regional agreements can also establish the link between SCM-IS practices and SMEs firm of Saudi Arabia, which consent better SCM and integration [35]. Cross border business collaborations are promoted for supply contracts to gain supplier effective sourcing from other countries.

Another enabler is establishment of better infrasturcutre for operations of supply chain. Absense of physical, financial and judicial infrasturctures are considered to be barriers to SMEs of Saudi Arabia [36]. SCM-IS practices can be strengthen by better infrastuctures to effect on OPER. Cooperation among regional and institutional entities and cooperation among firms and government for encouragement of various collaboration among organizations for setting up new product and development. SCM-IS related enablers are capble of expanding business opportunities for SMEs to improve their OPER through more effective adoptio of SCM-IS practices.

3. Research Methodology

Comparative analysis of SCM and IS practice's influences is the primary objective of the current study. Descriptive designed type of research is adopted for testing framework of research which includes supply chain management and information systems' promoting factors on OPER of small and medium enterprices in Saudi Arabia.

At this stage, formulation of hypotheses has taken place and tested empirically involving large sample of SMEs from SA. Multiple regression analysis has been taken to test relationship between variables in the study depending uopn the nature of study. This also provides a means to evalute the relationship between independent & dependent variables. Assessment of magnitude, sign and statistically coefficient for all independent variable [37]. Procedure of sample frame and collecting data, variable measurement are diescribed in next section of the study.

3.1. Sample and Data Collection

Self-administrated survey questionnnaire was circulated for data collection from Saudia Arabian SMEs. Development of sruvey instruments was to check the effect on supply chain management & information systems' practices, the promoting factors and impeding factors on saudi's smalle and medium enterprises OPER also explored with the interaction of SCM-IS practices. Pre-tested questionnaire was selected to ensure appropriate correct wording, format and sequence of questions. Typically, research on small and medium enterprices, researcher selected employees as respondants for basic definition and operatinoalization of SME. If an organization has less than 250 employees considered to be as SME. The organizations with less than 10 employees doesn't fit the set criterion of research and to exclude micro firms. This consistent ranged SME definition adopted by Saudi authorities.

Senior officers of SCM and IS activites were requested to complete the questionnaires total of 500. 172 questionnaires were returned in Saudia Arabia, largemissing values used to be the cause of elimination of sixteen surveys. Response rate was 31.2% among Saudi's Small and Medium Enterprices, which is acceptable in analysing results. Annual revenue, headcounts and difference in sub-industry as comparison of key demographical characteristics revelead no significant differnces among responding & firms with low response (p>.1).

[38] was followed for another non-response bias check to compare early respondant with late respondant. No-significant difference was found among respondant types with analysis of variances (p > 0.1) in study's construct in mean response. So that, it is evident that responses truely represents the sample.

3.2. Measurement of variables

Total of 11 SCM practices are identified which are applicable to SMEs, based on literature. It was asked to specific that upto what extant practices are implemented in firms. Similarly, 10 information system practices were setup to identified and measured with respondants to specify the extant of usage these information system practices in busienss units.

Enabler's set of 08 factors were also identified in context on SCM and IS practices. Respondants were requested to specify their perception related to these factors and implementaion of SCM-IS practices and their relavant importance. Further, set of seven inhibitors were identified and respondants were asked to indicate the role of these inhibitors during implanting supply chain management and information system's practices in these organizations.

Researchers also identified OPER's dimensions might be related to Small and Medium Enterprices contextually, generally it is known that selection of single measure of firm performance is difficult. So that, 07 OPER criteria was identified related to SCM and IS practices, respondants were asked to indicate the performance of firm over last 03 years in comparison of major competitors on given criteria. Table 1 provides the measurement of the study's

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constructs along with the exact wording of the items constituting SCM practices, IS practices, SCM–IS-related enablers and inhibitors, and
OPER.

4. Results and Discussion

Analysing the data and test was exectued is devided in 04 stages to check proposed hypotheses. Firstly, to identify mean difference between Saudi's SMEs for implementation level of SCM-IS practices, a number of univariate analyses was taken, perception of importance related to supply chain management and information system promoting and impeding factors and OPER level. In next setp, identification of dimensions of supply chain practices, informpation systems implementation and supply chain and information system promoting and impeding factors to test discriminant validity an EFA with varimax rotation was executed [39]. Extracted dimensions at second stage are uni-dimensional and presented as good fit, it was verified by CFA as measurement model was tested at the third phase. At the final stage, hierarchical regression analysis was executed to test the impact of constructs on OPER of Saudi's SMEs. Furhter discription is given in next phase.

4.1. *Univariate analysis*

Practices of supply chain management, technological advance system practices, information system related to supply chain management promoting and impeding factors, OPER their result related to Mean&SD (standard deviations) of these items are shown in table 1[1]. T-test statistics for comparison in Mean score of Saudi's SMEs is also given. Significant differences are identified between SMEs group related to implementation level of supply chain and information system practices [40].

4.2 *exploratory factor analysis*

In the current study, Spearman correlation coefficients was taken among consituent items of related variables ucovered inter-correlation of lower to moderation affect. Parsimonious set of distictive variables were produced from underlying items constructs for conceptual and statistical overlap. Each construct was rotated with EFA varimax rotation for extraction of underdiscussion dimension of sample of Saudi's Small and Medium enterprices. EFA's result is shown in Table 2. Different sources, outsourcing, and stock for safety measures as SCM practices were eliminated as resulted purification process as low or inapprpirate loadings. Remained 08 SMC practices yielded 02

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[1] Tables of results are not mentioned due lack of space. However, all tables of results are available on request.

factors along eignvalues were observed greater than '1' after EFA analysis.

The 02 labelled factors as supply chain practice (SCM1) and collaborative (SCM2) are on the base of item loadings. Cronbach's alpha of underlying factors are respectively 0.67 and 0.61; as acceptable level of construct reliability [41].
Similarly, potential distinctive dimension of IS practice was explored by carring out EFA. One IS practice elimination with low and / or inappropriate loading (MRP), two factor was produced and explained 56.8% of observed variance by factor analysis. 0.81 and 0.69 was recorded Cronbach's alphas for factors to be considered respectively. These labelled factors considered as intrafirm information-system practice (IS1) and interfirm Information system practices (IS2). Similarly, EFA for supply chain management & information system promotors expalined 63.7% of observed variance. Label of factors as 'cooperation building' (ENAB1) and 'infrastructure building' (ENAB2) respectively. Values of Cronbach alpha for ENAB 1 and ENAB 2 recorded as 0.79 and 0.76 respectively, acceptable as satisfactor level of reliability. Nevertheless, set of 07 SCM-IS inhibitors were loaded into single factor explains as 62.7% of the observed variance. Value of Cronbach's alpha is shown in table 2, which is 0.90 for SCM-IS inhibitors. Similarly, set of 07 OPER measures recorded into signle factor explains as 61.7% observed variance and Cronbach alpha was recorded as 0.88; which signify adequacy of construct realiability.

4.3. *Confirmatory factor analysis*

At this stage, test of relevant cosntruct was taken by using first order confirmatory factor for evaluting validity of construct as same method. Structure of factors for all variables as recorded before at EFA stage was supported conssistently as result showed. Basis of CFA was on comparison of sample and model variance-covariance matrices.

Table 2 represent the result of measurement model at aggregated level of relevant constructs. Regression weight among all itmes and latent variable as correspondant where all weight in CFA found as significant (p< 0.001) in table 2. Table 3 demonstrate good fit indices for selected variables. Commonly accepted standards stems out these indices conform. The value of $\chi 2$ ranges from 42.11 to 141.25, with the values of $\chi 2/df$ ratio varying between 1.37 and 3.24. Normal range of ratio should be between 0-5 and slower value indicate better fit. Models fits with the criterion as shown by the results. Additionally, GFI, AGFI, CFI are highly acceptable for relavant constructs as they are closer to 1.0, which represent perfect fit. Construct validity is also attested for measurement model of all constructs.

4.4. Regression analysis and hypotheses testing

Descriptive statistics & co-rrelations among study's variables are represented in table 4. Pariwise correlations don't present multicollinearity problem for regression analysis, as coefficients are above 0.50. Each group of SME was used to test hypotheses by using hierarchical regression analysis. IVs were the construct resulted from factor analysis. At the frist stage major effects were entered and effects related to enablers and inhibitors were entered at the 2nd and 3rd stage respectively. Table 5 represents regression results.

Telerance values and variance inflation factors examined for multicollinearity for each regression analysis. Tolerance values recorded as more than 0.41, and VIF score was 2.58; which indicate multicollinearity is not considered as a problem (Hair et al. 1998). All three model are significant ($p<0.01$) indicated by F-statistics, a linear fit to data set is identified. Adjusted R^2 given values of models 1-3 was ranged 0.32 and 0.72, accepted as satisfactory explantory power. Indication of model 1 shows total 07 indicator varibales and following four have significant effect on OPER of Saudi SMEs. Supply practice ($p<0.01$), *intrafirm IS practices* ($p < .05$), *infrastructure building* ($p < .01$), and *SCM–IS inhibitors* ($p < .01$). Partial support to H1 is provided by Models 1 as the significant positive signs are observed. Sample provided stong support to H2, OPER of small and medium enterprices got effected by information system practices adoption as evident in Models 1 of table 5. In table 5, intrafirm IS practice and interfrims IS practice are found significant ($p<0.01$). However, H2 support was relatively less for the sample but intrafirm IS practices found significant ($p<0.05$).

5. Conclusion and Implications

The current study has explored the impact of supply chain management and information system implementation on primarialy basis, Supply Chain Management & Information System related supportive and impeding factors on small and medium enterpreices OPER within Saudi's SMEs; while rely on the executive's perceptual data. Saudi's SMEs are found to emphasis more on enabling factor, regarding the relevant significant of supply chain management and information system pormoting factors. However, there is not any significant difference has been identified in terms of relative frequency of SCM-IS related inhibiting factors. Saudi's SMEs were observed with better performance level regarding the level of OPER. For the identification empirical validatation of dimension of research's construct was developed by both exploratory and confirmatory factor analysis. Regression analysis indicated that SMEs' OPER were influenced by practices of supply chain management and information system as well as promoting factors of supply chain and information system positively. Besides,

effects on small and medium enterprices' OPER perceived insignificantly by SMEs of Saudia; as they show contradiction with the perception of other countries SMEs.

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