

Effects of SCOR on Management of Supply Chain

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ABSTRACT: *The paper inspects the relationship between the plans, source, make, and delivery areas of the supply chain management with performance. The results of the paper are united by sample of 55 respondents of various companies in various industries. The results propose the significant existence of relationship among the plan and make with supply chain performance. The relationship of source and delivery with performance cannot be supported by data. The results indicate an improved understanding for those areas in which right decisions can bring better performance in the supply chain.*

Keywords: SCM, Analytical Capability, Performance, SCOR, Plan, Source, Make, and Delivery.

In this modern era the competition is not among the organization, it now has been changed to supply chains. It is a new area to get the competitive advantage by managing effective chain of supplies (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006). It is still in debate that how the SCM influences on performance of the business, and the areas that are important in supply chain.

The topic has its significance, because to get the competitive advantage it is necessary to increase effectiveness and responsiveness of SCM (Sahay & Ranjan, 2008). BA is an important instrument for SCM (Kohavi, Rothleder, & Simoudis, 2002), optimization techniques are now essential part for business process (Valente & Mitra, 2007). The right decisions can only be taken by correct use of external and internal data, and it is only possible with business analytics (Sahay & Ranjan, 2008). Therefore the research significance in BA is increasing (Jourdan, Rainer, & Marshall, 2008).

The paper contributes in the analysis of the influence of BA on diverse areas of SCM. The arrangement of the research paper is like: importance of business analytics and its influence on supply chain, then research model have been presented, after that methodology and results have been presented. The last part consists of the conclusion which discusses the implications of the research, draw the limitations of the research, and also elaborate the topics for future research.

Literature Review

In this particular research paper BA (Business Analytics) is defined as applying different analysis techniques on the data to give the answers of the questions or solve the problems related to SCM. BA is not the technology in real it is organizational procedures, tools and approaches to collect information, then analyzing the information and predicting the outcomes of different problems in four spots of SCOR (Plan, Source, Make, and Deliver.) (Bose, 2009).

The well planned SCM system help organization to success, because financial performance get better the stock turnover improves along with reduced expenditures on sales. These are some basic advantages additional can also be recognized (Dehning, Richardson, & Zmud, 2007). In past decades the large investment is made on supply chain systems yet these systems are struggling to get competitive advantage (Sahay & Ranjan, 2008). The worse thing is there is lack to evaluate the business

value (Elbashir, Collier, & Davern, 2008). Most of the research papers have discussed the initial experience and not the improvement along with the time (Wixom, Watson, Reynolds, & Hoffer, 2008). Therefore it is an essential to study the effect of BA, factors that help the impact along with areas of supply chain management. This paper has focused on this area.

The paper focused on the link between information and the use of this information is the critical factor for performance of the organization (Fairbank, Labianca, Steensma, & Metters, 2006; Henderson & Venkatraman, 1992). SCM focuses on the use of information to improve the processes and the outcomes (Hult, Ketchen, & Slater, 2004) and good SC practices could be helpful for increasing the processing capacity of information (Zhou & Benton, 2007).

In this paper information attained in for SCOR is examined.

Sway of business analytics on performance of supply chain: Supervising and developing the performance of the SC is a complex task now a day which includes numerous processes like identifying the measures, target defining, monitoring, reporting, planning, communication and feedback (Cai, Liu, Xiao, & Liu, 2009). Therefore conventional approach like benchmarking for SC decision is useless.

So, data analysis is necessary for all the applications of business (Cadez & Guilding, 2008). Same is in SC situation because a right decision is based on external and internal bundles of data this could only be done by BA, as it can only enable to analyze large data gathered on regular basis (Azvine, Nauck, & Cui, 2005; Sahay & Ranjan, 2008). The example is the framework of supplier evaluation as the organizations have many suppliers it could not be done without BA.

BA use has been increased in SCM. Improvement in the supply chain performance is now a continuous process therefore there is a need for performance measurement system (Cai et al., 2009). In addition to this BA helps in increasing the efficiency of the organization, using the different analytical methods by reducing the operating cost and correctly forecasting trends of market (Hedgebeth, 2007). The companies can cut their cost and can increase the profits by implementing the mature SC system (Hoole, 2005). The performance can be improved along with competitive advantage by high SCM practices and high quality of information sharing (Li et al., 2006). As it is a complex process SC

management could be done by software to standardize the operations. Competitive advantage can be got by implementing a good decision support program. It should be managed carefully to get fruitful results (Shang, Tadikamalla, Kirsch, & Brown, 2008). Just implementation of the IT system is not enough the main issue is the best utilization of the software and the data provided by it. Many of the organizations have these software's but the problem is they cannot utilize the data and information to make a good strategic decision (Ranjan, 2008). The organization should evaluate their models constantly to check the utility, and should update or change the models at the time of need it can provide knowledge about changes in conditions that can affect performance (Curtis, Seshagiri, Reifer, Hirmanpour, & Keeni, 2008).

How business analytics sway the performance: It have been discussed that BA have a positive impact on supply chain performance but there is still need to understand potential ways of this impact. In many research papers SCM have been used as umbrella to find the results of this impact. It is a fact that SCM is a broad term that connects different business units to fulfill the demand of customers (Stadtler, 2005). Supply chain management is diverse still with consensus on some of its concepts (Burgess, Singh, & Koroglu, 2006) and include almost all business activities. SCOR have been used for SC on past years (Bolstorff & Rosenbaum, 2003; Cai et al., 2009; Huan, Sheoran, & Wang, 2004), in this paper it is being used as a framework. It is a systematic approach to identify, evaluate and monitor the performance of supply chain (Cai et al., 2009; Lockamy & McCormack, 2004b). The model of SCOR is a system for performance measurement at various levels that covers the SC processes (Plan, Source, Make, Deliver, and Return) (Cai et al., 2009). It is very useful model for strategic nature decision making for supply chain (Huan et al., 2004). It also provides the framework, terminology that could be used for evaluation, positioning, and implementation of supply chain process (Huan et al., 2004). Supply chain analysis includes plan, source, make and delivery (Sahay & Ranjan, 2008).

Examples elaborate the use of analytics in different areas:

In Planning: data is analyzed to forecast the market trends for the products and services this is mostly done in the shape of monthly or yearly reports made by marketing or finance departments (Azvine et al., 2005).

In Source: agent based system for procurement that include model, evaluation, search and negotiation

agents for improving the selection of supplier, negotiating for price (Lee, Lau, Ho, & Ho, 2009), and supplier selection and evaluation approach.

In Make: production of products should be correct, well on time, and each production batch should be correct also (Ranjan, 2008).

In Deliver: BA has many applications for logistics management to bring products at right time to the market (Reyes, 2005). The delivery decisions are taken at end and many organizations have outsourced the deliver process, BA influence on delivery decisions could be limited. So, the improvement in these areas will ultimately increase the performance of the supply chain (Lockamy & McCormack, 2004b). The influence and impact of the four areas is still measurable.

The BA instruments have not only effectively integrated previous organizational ISs instead they are now the essential part for organizational processes of the business. The SCOR can only be benchmarked if the data is collected automatically (Gulledge & Chavusholu, 2008). IT and the business processes should be linked to bring such developments. It is not easy to separate the benefits derived from IT or by changing process (Auramo, Kauremaa, & Tanskanen, 2005). This could be understood that companies interconnect with each other on real time and their processes are across various departments (Schiefer & Seufert, 2005). Internet allows now organizations to improve their cross functional business processes with customer and suppliers (Muylle & Basu, 2008).

Research Model

Research model was used in order to analyze relationship of BA in SCM and performance in SCOR planning, make, supply and then deliver areas.

Methodology: The current study involves both as a descriptive and the exploratory character because it aims towards describing and organizing information for the sway of analytics on supply chain performance.

The research made on previous research that collected data on supply chain management maturity (Lockamy & McCormack, 2004a). In the survey questions were included about key supply chain decision and level of their use in SC. Literature review, discussions along with interviews with SC expert was used in original research as a basis to develop survey questions. Discussions along with the

interviews were prepared around SCOR model. Experts used to develop and validate the original measure were selected from the member list of SC council. The list covers many industries and contain employee working in SC domain. In this research, detailed measures that represent only the analytics practices in every area of SCOR decisions were recognized and validated by making a list of the candidates of the analytics practices and moving the list in SCM experts, and then they were asked to accept the measures or reject it by putting BA in to practice.

The supply chain performance test is self-assessed performance rating test for every SCOR decision. The test is based on the perceived performance, determined by respondents of the survey. For every decision area it is characterized as single item. Particular item statement on supply chain performance for every SCOR decision is: "Overall, this decision process area performs very well." Participants of the survey were asked to agree or disagree with item statement by using five point Likert scale (1=strongly disagree, 5=strongly agree). We determined general method orientation of organization (definition, culture along with horizontal structure) by using standards that were developed in previous research rather any particular BPM approaches. Moreover, BPM is wide term, it can be professed differently by every respondent. Value of technology depends on tasks of user. Therefore the evaluations of users can reproduce differences in underlying systems or services offered to the users (Goodhue & Thompson, 1995). Majority of the survey contributors were technology users related to business and they generalize all the technologies.

Data Collection: The instrument for the survey was developed with the likert scale of 5 point: 1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly

agree. The questions in the instrument focus on decision making ability in key areas of supply chain decisions for each four areas SCOR. Initially the survey was conducted in the textile sector with their supply chain experts. After these test several improvements were made in instrument.

Then after improving the instrument the detailed survey was conducted in textile and fast food industry, the instruments were sent to the employees of the organization by post and electronically. In total 100 instruments were distributed in different organizations six to eight per organization. The respondents were assured that there provided data and personal information will be kept confidential. The 55 instruments were sent back to researchers. Overall the 36 respondents were men and 19 were women, age of them was 22 to 50. The students and unemployed persons were not included in this survey.

Data Analysis: The analysis was based on correlation and regression using SPSS software. Descriptive statistics used central tendencies, mean, correlation, and standard deviation. In order to test the hypothesis and relationship between variables Pearson's Correlation was used along with regression by using SPSS software.

Table 1 that is given below shows the descriptive statistics: mean of variables, standard deviation of variables, and Pearson coefficient of correlation between the research variables. Using SPSS software the Pearson's correlation was run to find out the relationship in variables, and too many significant correlations were observed among variables. All the SCOR areas have impact on the performance. Performance was significantly and positive related to the Plan ($r=0.612$, $p<0.01$), to Source ($r=0.390$, $p<0.01$), to Make ($r=0.639$, $p<0.01$), and to Delivery ($r=0.514$, $p<0.01$).

Table 1: Mean, Standard Deviation, and Correlation

	Mean	S.D	1	2	3	4
1-Plan	4.5884	.31241				
2-Source	4.5091	.38177	.455**			
3-Make	4.5481	.32503	.595**	.689**		
4-Delivery	4.5758	.34519	.877**	.551**	.649**	
5-Performance	4.6045	.35905	.612**	.390**	.639**	.514**

N=55, * $p<0.05$, ** $p<0.01$

To test the hypothesis with regression, performance was set as a dependent variable, while plan, source, make, and delivery were taken as the independent variables. Analysis showed results of coefficients from independent to dependent variables. The tables that were made using "Enter" method for regression analysis are given below Table 2. The tables includes model summary, coefficients of variables, and ANOVA table. In the model summary, value of R is 72.4%, which shows the correlation between predicted values for the dependent variable. The R-square is showing proportion of the variance in dependent variable (performance), it could be explained by independent variables (plan, source, make, and delivery). It is showing the association

and strength in variables. The R-square value indicates that 52.4% variation in performance is caused by predicting variables; Remaining 47.6% variation is caused by other factors.

ANOVA table indicates the significant F statistics ($F=13.750$, $p<0.001$), which indicates that using the model is better than guessing the mean. Now taking the standardized regression coefficients into consideration, independent variables i.e.

Table 2. Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.724	.524	.486	.25749

ANOVA Table

Model	Sum of Squares	df	Mean Square	F
1 Regression	3.646	4	.912	13
Residual	3.315	50	.066	
Total	6.961	54		

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	.543	.575		.944	.349
	Plan	.722	.236	.628	3.059	.004
	Source	-.077	.130	-.082	-.595	.555
	Make	.604	.168	.547	3.606	.001
	Delivery	-.361	.229	-.347	-1.575	.122

a-Dependent variable: Performance.

b-Independent variables: Plan, Source, Make, and Delivery.

Discussion and Conclusion

It is clear from the results that use of business analytics in process areas has impact on supply chain performance. The findings are confirmed by the huge sample of the companies that are of different industries. The results reinforce the significance of use of planning and making decisions can affect the performance of supply chain.

In addition to this those companies using the good plan and make approach are more capable to perform better.

Interestingly, the data driven results gives the limited support to impact of delivery and source. This is possibly that the delivery is mostly outsourced and the decision related to delivery are taken at end of the process, another explanation is that the marketing/logistics cooperation have no straight influence on the firm performance (Chen, Mattioda, & Daugherty, 2007), companies might not have the advanced use of business analytics. The results could be different if samples had been used by e-business (e.g. online retailers) in this case the delivery effect could be stronger on performance (Cho, Ozment, & Sink, 2008). However, results did not give support to the source and delivery effect on performance, the reason could be SCs are similar to the functional areas of an organization and focused on one task so the use of BA is possible if the organizations are more functionally oriented.

The investment in SCOR and BA is favorable for organization, because gathering a complex data could be difficult and time consuming for organizations (Davenport, 2009). The company may be unable to put efforts in the SCOR areas i.e. plan, source, make, and delivery (Lockamy & McCormack, 2004b; Stewart, 1997). These results indicate that the investment made in plan and make can be significantly important for organization. The investment depends on characteristics of company or supply chain of the company.

Limitations

This research paper has some limitations. The companies selected in the sample may not be randomly selected completely because the companies that were more aware of the SC were taken in to participate. Moreover the respondent information or evaluation cannot always be accurate to reflect the real quality (Goodhue & Thompson, 1995). Lastly, the existing trust in between the companies in chain is not included in studies, because without the trust companies do not share their data with the others (Terzi & Cavalieri, 2004).

Future Research

The paper gives the understanding of various areas of SCM, where the processing is more important. Further research is necessary to recognize the factors that manipulate the other area. Future research can include the case study in order to acquire the complete view of how business analytics sway on the various areas of the performance.

Future research must examine if the different kinds of IS (e.g. Enterprise resource planning ERP, web services) have effect on areas of supply chain performance. Performance was taken as a construct in the paper, a

more needed research investigation could be how business analytics in SC areas influence different performance metrics, e.g. Well on time delivery, the quality, the cost, the reliability and the flexibility.

At last, the analysis of those areas of SC on which a company should focus for getting benefits.

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