

RESEARCH PAPER

Does supply chain coordination impact supply chain performance? Evidence from dairy industry

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ABSTRACT

The objective of this study is to identify extent of coordination among the supply stakeholders; measure supply chain performance and to study the impact of supply chain coordination on supply chain performance. The study is based on primary data collected from dairy supply chain stakeholders namely farmer-producers, bulk milk coolers (BMC), processing unit, wholesalers and retailers. The data was collected through combination of personal interviews, telephonic interviews and e-mail. The total sample size of this study is 420 spread across 28 firms with each firm representing a total of 15 respondents. Linear regression was performed to study the impact of supply chain coordination on supply chain performance. The results of this study reveal that supply chain coordination positively impacts all the supply chain performance metrics namely efficiency, responsiveness, flexibility and quality. Supply chain coordination has highest impact on supply chain responsiveness followed by supply chain quality, supply chain flexibility and supply chain efficiency. In case of impact of supply chain coordination on overall supply chain performance, there is an evidence of strong impact of supply chain coordination on supply chain performance.

KEY WORDS : Supply chain coordination, Supply chain performance, Dairy industry

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The business environment has turned highly competitive and ever changing consumer needs. In order to remain competitive in the industry,

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firms require integrating and coordinating their business processes and strategy (Green *et al.*, 2008). In this context, firms make best use of their supply chains to fulfill customer requests to achieve success at supply chain level that ultimately converts to organizational success (Chopra and Meindel, 2003). The importance of supply chains in achieving organizational successes has generated the interest of researchers, industry practitioners and academicians in supply chain performance measurement (Widyaningrum and Masruroh, 2012 and Govindan *et al.*, 2017).

A supply chain is a system of organizations that are

involved in planning and movement goods and services; from point of origin to point of consumption (Myerson, 2015) and supply chain management is the philosophy that guides the firms in movement of goods and services from point of origin to point of consumption (Cooper *et al.*, 1997).

A supply chain is viewed as a unified system where all the stakeholders coordinate with each other and this is where coordination in a supply chain comes in to the focus (Kanda and Deshmukh, 2008). Supply coordination is occupies prime position in the supply chain (Ballou *et al.*, 2000) and it is a mechanism to redesign workflow and resources to achieve better supply chain performance (Lee, 2000).

The supply chain issues are different for each industry and agri-food supply chain is very different and challenging due to unique its characteristics such as perishability, seasonal production, variation and quality and quantity (Van Der Vorst, 2000). Though the focus and orientation of agri-food supply chain has changed over the years (Aramyan *et al.*, 2006); however, maintenance of quality across the supply chain of highly perishable commodities like milk and milk products is extremely challenging. Therefore, dairy supply chain requires coordination of all stakeholders at their interface to ensure movement of milk and its products while maintaining its quality. A typical dairy supply chain in India consists of farmers, cooperative societies/private collection centers, bulk milk coolers, processing units, wholesalers, retailers and consumers (Mor *et al.*, 2020). Milk and its products flow through various routes in India which consists of organized and unorganized networks. The unorganized dairy network dominates Indian market through which more than half of milk is marketed (Maaz *et al.*, 2020).

The dairy industry is one of the largest employment providing sector in the country, yet this sector lacks behind in terms of exports and competitiveness (Madhavan *et al.*, 2020). There is general consensus among the researchers that success at supply chain level is needed for overall growth of dairy industry.

In this context, this study has been designed to demonstrate how supply chain performance could be enhanced by improving coordination of supply chain stakeholders. The scope of this research extends to all the stakeholders of dairy supply chain. However, only organized sector has been included because the

unorganized sector does not include all the flows of a typical dairy supply chain. Though the present study is unique in many ways; there are two major contributions of this study to the existing literature. First, the present study has included entire supply chain stakeholders to get a comprehensive understanding of supply chain coordination and supply chain performance. Second, the present study demonstrates evidence of relationship between supply chain coordination and supply chain performance from the dairy industry.

The objectives of this study are:

- To study the degree of coordination between dairy supply chain stakeholders.
- To study the performance of dairy supply chain.
- To study the impact of supply chain coordination on supply chain performance.

Hypotheses:

H_{01} :

There is no positive and significant relationship between supply chain coordination and supply chain performance.

$H_{01.1}$:

There is no positive and significant relationship between supply chain coordination and supply chain efficiency.

$H_{01.2}$:

There is no positive and significant relationship between supply chain coordination and supply chain flexibility.

$H_{01.3}$:

There is no positive and significant relationship between supply chain coordination and supply chain responsiveness.

$H_{01.4}$:

There is no positive and significant relationship between supply chain coordination and supply chain quality.

Theoretical framework:

Supply chain coordination:

Supply chain is a strategic response that seeks to

address the challenges arising out of dependencies among the supply chain stakeholders (Xu and Beamon, 2006). Supply chain coordination is the coming together of different business activities across organizational boundaries (Chandrashekar and Schary, 1999); it is a win-win proposition that provides improved business performance for all the parties (McClellan, 2003). A supply chain is made up of different streams that are interdependent of each other (Ballou *et al.*, 2000), therefore, coordination among the supply chain stakeholders is a pre-requisite to achieve the goals of supply chain (Simatupang *et al.*, 2002). The performance of a supply chain is largely dependent on how well its stakeholders coordinate (Chen, 2003). Supply chain coordination provides several benefits such as elimination of excess inventory, increase in sales, better customer service, increased efficiency in production, increased flexibility etc. On the other hand, lack of coordination in supply chain causes mismatch in demand and supply, increased costs of stock out, excess inventory etc. (Horvath, 2001). Lack of coordination in a supply chain has caused US food industry wastage of \$30 billion annually (Fisher *et al.*, 1994).

Supply chain performance:

Measurement of supply chain performance is an important step in successful management of supply chain (Gunasekaran *et al.*, 2001). The need for measuring supply chain performance gave rise to several supply chain management systems. However, these supply chain measurement systems cannot be applied directly to agri-food commodities due to their specific and unique characteristics. Therefore, supply chain performance measurement systems that could be applied to agri-food commodities were proposed by (Prakash and Pant, 2013; Susanty *et al.*, 2017 and Moazzam *et al.*, 2018). The present study has adopted the supply chain performance measurement system given by (Aramyan *et al.*, 2006). This framework measures supply chain performance through four metrics namely efficiency, responsiveness, flexibility and quality.

Efficiency is the ratio of input to output. In other words, it is the amount of output generated through inputs. Efficiency is measured through costs and profits. Costs include production, storage, transportation, inventory etc. Flexibility is the degree to which supply chains can change based on customer requests. Metrics for measuring

flexibility include volume flexibility, delivery flexibility and customer satisfaction. Responsiveness of a supply chain is the extent to which a supply chain can respond to customer demands. Supply chain flexibility is, measured through metrics such as fill rate, product lateness, customer response time and shipping errors. Quality in the context of supply chain measures product quality and process quality. Product quality includes sensory and physical attributes of a product such as freshness, texture, smell, taste etc.

METHODOLOGY

Questionnaire development:

The data was collected through a well-designed questionnaire. There are three constructs in the study namely supply chain coordination and supply chain performance. The variables under these constructs were converted in to five-point likert scale (strongly disagree, disagree, neither agree nor disagree, agree and strongly agree or very low, low, moderate, high and very high).

Population and data sources:

The population of this study constitutes all the supply chain stakeholders of dairy industry in Telangana state of India. The rationale behind choosing of state of Telangana is because of its status as youngest state of India and it is known for successful dairy cooperatives and private dairy brands.

Sample selection and survey administration:

The data was collected from dairy supply chain stakeholders of cooperative and private dairy industry in Telangana state. In administering the survey, the first task was identifying the managers working in dairy processing units in Telangana state. The managers were then interviewed personally; few managers were interviewed over phone and few managers were contacted for data over e-mail. This exercise was carried out for 3 months and 28 firms were covered. In the next step, we generated forward and backward flows of each firm and they were contacted. Two Bulk milk coolers (BMC) from each firm were contacted for interviews using simple random sampling; subsequently, three farmer-producers from each BMC were included in the sample using systematic sampling. In the next step, two wholesalers from each firm was included in the sample using random sampling and two retailers from each

wholesaler was included in the sample using simple random sampling. Therefore, total sample size at the end of data collection is 420 with each firm consisting of 15 respondents. A summary of survey administration is given in the Table 1.

Data analysis:

The raw data collected was converted into scores by adding all the values corresponding to a single firm and then dividing it by number of stakeholders. Using this procedure, mean scores for all the variables was calculated to arrive at mean scores for supply chain coordination, supply chain efficiency, supply chain flexibility, supply chain responsiveness and supply chain quality. The data was processed in SPSS v22 to analyze the hypothesized relationship. Linear regression analysis was performed to test the relationship between supply chain coordination and supply chain performance.

ANALYSIS AND DISCUSSION

The findings of the present study as well as relevant discussion have been summarized under the following heads :

Reliability analysis:

The variables were tested for internal consistency using cronbachs’ alpha. The values of cronbachs’ alpha must be greater than 0.70 to be considered as having good internal consistency (Olorunniwo *et al.*, 2006) and (Maaz *et al.*, 2019). All the variables have internal consistency greater than 0.70 thus establishing good internal consistency of the variables.

The Table 2 illustrates the degree of cooperation among the dairy supply chain stakeholders. All the mean scores of supply chain coordination among the stakeholders are above 3 indicating effective coordination among the stakeholders. The highest mean score of supply chain coordination is at the interface of BMC

Table 1: Summary of survey administration

Respondent	Number	Number of respondents corresponding to a single firm	Sampling technique	Method of data collection
Producer-farmers	168	6	Systematic	Personal interview
BMC	56	2	Simple random	Personal/telephonic interview
Processing unit	28	1	-	Personal/telephonic/mail interview
Wholesalers	56	2	Simple random	Personal/telephonic interview
Retailers	112	4	Simple random	Personal/telephonic interview
Total	420	15		

Source: Field survey

Table 2 : Supply chain coordination among the dairy supply chain stakeholders

Stakeholder interface	Mean
Producer-BMC	3.89
BMC-processing unit	4.32
Processing unit-wholesalers	4.01
Wholesalers-retailers	3.16
Overall supply chain coordination	3.84

Source: Field survey

Table 3: Supply chain performance of dairy industry

Stakeholder interface	Mean
Efficiency	3.44
Flexibility	3.07
Responsiveness	3.13
Quality	3.52
Overall supply chain performance	3.29

Source: Field survey

and processing unit indicating the processing unit and BMC share timely information and coordinate their operations in best possible manner. The coordination at the interface of processing unit and wholesalers has a mean score of 4.01 which comes next to BMC-processing unit interface. The mean score of coordination at producer and BMC interface is 3.89 which is little less than processing unit and wholesalers' coordination. The lowest mean score of coordination is at the interface of wholesalers and retailers.

Table 3 illustrates the supply chain performance of dairy industry. Quality of the supply has the highest mean score followed by efficiency and responsiveness. Flexibility has the lowest mean score among the supply chain performance metrics. All the metrics of supply chain performance have mean scores greater than 3 indicating that all the supply chain performance metrics are performing well above the average. The overall supply chain performance is 3.29 which shows that dairy performance of dairy supply chain is nearly good.

Impact of supply chain coordination on supply chain performance:

Before performing the linear regression analysis, variables were tested for normality, homoscedasticity and multicollinearity to determine if they are fit for regression analysis.

The normality of the data has been tested using normality probability plot. The normality probability plot for all the variables have dots spread around the diagonal

line confirming normality of the data. The homoscedasticity assumption was tested using scatter plot chart diagram. The dots on the scatter plot chart were spread across the chart without any specific pattern confirming homoscedasticity of the data. The multicollinearity assumption was tested using VIF (variance inflation factor) values. The VIF values of all the variables are less than 10 confirming the absence of any problems with multicollinearity. In the absence of any problems in these three assumptions, the data is fit for regression analysis.

The data was analyzed to check the impact of supply chain coordination on individual supply chain performance metrics. The beta value of supply chain efficiency is .219 which implies that increase in supply chain coordination by 1 unit will increase supply chain performance by .219 units. The p value for relationship between supply chain coordination and supply chain performance is .021 which is less than .050, therefore, $H_{01.1}$ is rejected indicating that supply chain coordination positively impacts supply chain efficiency.

The standardized beta value of supply chain flexibility is .315 which means that increase in supply chain coordination among the supply chain stakeholders by 1 unit will increase supply chain flexibility by .315 units. The p-value for hypothesized relationship between supply chain coordination and supply chain flexibility is 0.002 which is less than .05, therefore, $H_{01.2}$ is rejected. There is evidence of positive impact of supply chain coordination on supply chain flexibility.

Table 4: Impact of supply chain coordination on individual supply chain performance metrics

Dependent variables	Supply chain coordination (Independent variable)			Inference
	Beta	t-value	P value	
Supply chain efficiency	.219	3.214	.021 *	Hypothesis $H_{01.1}$ is rejected
Supply chain flexibility	.315	4.452	.002 *	Hypothesis $H_{01.2}$ is rejected
Supply chain responsiveness	.542	8.107	.000 *	Hypothesis $H_{01.3}$ is rejected
Supply chain quality	.389	4.769	.000 *	Hypothesis $H_{01.4}$ is rejected

Source: Field survey

* indicate significance of value at P=0.05

Table 5: Impact of supply chain coordination on overall supply chain performance

Dependent variable	Supply chain coordination (Independent variable)			Inference
	Beta	t-value	P value	
Supply chain performance	.637	6.013	.000 *	Hypothesis H_{01} is rejected
R:	0.637			
R-square:	0.405			
Constant:	0.137			
F- value:	109.31 (0.000*)			

The standardized beta value of supply chain responsiveness is .542 indicating that an increase in supply chain coordination by 1 unit will cause an increase of .542 units in supply chain performance. The p-value of hypothesized relationship between supply chain coordination and supply chain responsiveness is 0.000; therefore, $H_{01.3}$ is rejected providing evidence of positive impact of supply chain coordination on supply chain responsiveness.

The standardized beta value of supply chain quality is .389 indicating that an increase in supply chain coordination by 1 unit will bring an increase of .389 units in supply chain performance. The p-value of hypothesized relationship between supply chain coordination and supply chain responsiveness is 0.000, therefore, $H_{01.4}$ is rejected implying that there exists positive relationship between supply chain coordination and supply chain performance.

The Table 5 represents the results of linear regression where supply chain coordination is independent variable and supply chain performance is dependent variable. The value of F is 109.31 and p-value of F is 0.000 indicating that model is statistically significant. The value of R is 0.637 which implies that 63.7 per cent of changes in supply chain performance are explained by supply chain coordination. The value of constant is 0.137 which means that if the value of independent variable is set to zero, the value of dependent variable will be 0.137.

The standardized beta value is 0.637 which means that increase in supply chain coordination by 1 unit will cause an increase of .637 units in supply chain performance. The p value of hypothesized relationship between supply chain coordination and overall supply chain performance is .000 indicating that there is positive relationship between supply chain coordination and overall supply chain performance. Therefore, H_{01} is rejected.

Concolusion:

Supply chains are integral part of modern businesses. The competition today is between two supply chains and not between two businesses (Christopher, 1992). Effectively managed supply chains not only reduce cost of production but also improve customer satisfaction. Success at the level of supply chain translates into success at organizational level. Therefore, supply chain

performance must be enhanced through proper coordination of supply chain stakeholders.

The present study is an attempt to demonstrate empirically the impact of supply chain coordination on supply chain performance. the data for this study has been collected from all the stakeholders of dairy supply chain.

The results of this study show that there is excellent coordination at the interface of processing units. The processing units are maintaining cordial relations and sharing/receiving timely and updated information from their immediate forwards and backward linkages. The overall supply chain coordination is also well established in the dairy supply chain.

The performance of dairy supply chain is above average. Supply chain quality and supply chain efficiency has highest performance score in the supply chain performance. The overall supply chain performance is also above average indicating that dairy supply chain is performing well.

In case of impact of supply chain coordination on individual supply chain performance metrics, responsiveness is most likely to be impacted by changes in supply chain coordination. This may be due to the fact that better coordination among the supply chain stakeholders gives timely information, therefore, supply chain partners respond them positively to the customer needs and demands. Efficiency, flexibility and quality all are positively impacted by supply coordination.

The overall supply chain performance is positively impacted by supply chain coordination. The overall model is statistically significant and supply chain coordination brings about 63.7 per cent changes in supply chain performance indicating strong impact of supply chain coordination on supply chain performance.

The results of this study demonstrate that supply chain coordination must be enhanced if success at the level of supply chain is to be realized. The managers working at the processing units must make efforts to enhance coordination at all levels of supply chain. The supply chain must have formal mechanisms to ensure smooth coordination among all the stakeholders. The use of formal procedures/systems tin supply chain coordination will offer seamless coordination at all the supply chain interfaces. As shown in this study, high amount of changes in supply chain performance is brought about by supply chain coordination. Therefore,

supply chain coordination must be treated as a strategic business process rather than routine business processes. Incorporating supply chain coordination in supply chain strategy will ensure supply chain stakeholders plan and implement coordination at their interfaces in a scientific manner.

Though all efforts were taken to conduct this study in most scientific manner, there are few limitations in this study. First, this study has taken only coordination as an antecedent to enhanced supply chain performance. However, in reality there are many issues that converge to the individual stakeholder level to impact supply chain performance. Therefore, future studies may incorporate other variables to test this relationship. Second, the present study is confined to a single industry, the results of external validity are not yet known. Therefore, future studies may test this relationship in different industries so further strengthen the results of this study.

REFERENCES

- Aramyan, L., Ondersteijn, C., Kooten, O. V. and Lansink, A. O. (2006). Performance indicators in agri-food production chains, C. Ondersteijn, J. Wijnands, R. Huirne and O. V. Kooten, *Quantifying the agri-food supply chain*, The Netherlands: Springer, pp. 47-64.
- Ballou, R.H., Gilbert, S.M. and Mukherjee, A. (2000). New managerial challenges from supply chain opportunities. *Industrial Marketing Management*, **29** (1): 7–18.
- Chandrashekar, A. and Schary, P.B. (1999). Toward the virtual supply chain: the convergence of IT and organization. *The Internat. J. Logistics Management*, **10** (2): 27-40. <https://doi.org/10.1108/09574099910805978>.
- Chen, F. (2003). Information sharing and supply chain coordination. *Handbooks in Operations Research & Management Science*, **11** : 341-421.
- Chopra, S. and Meindl, P. (2003). *Supply chain management: Strategy, planning and operation*. New Delhi, India, Pearson Education.
- Christopher, M.L. (1992). *Logistics and Supply Chain Management*. London: Pitman Publishing.
- Cooper, M. C., Lambert, D. M. and Pagh, J. D. (1997). Supply chain management: More than a new name for logistics, *The International J. Logistics Management*, **8** (1): 1-14.
- Fisher, M.L., Raman, A. and McClelland, A.S. (1994). Rocket science retailing is almost here: Are you ready? *Harvard Business Review*, **72** (3): 83–93.
- Govindan, K., Mangla, S. K. and Luthra, S. (2017). Prioritising indicators in improving supply chain performance using fuzzy AHP: insights from the case example of four Indian manufacturing companies, *Production Planning & Control*, **28** (6) : 552-573.
- Green, K. W., Whitten, D. and Inman, R. A. (2008). The impact of logistics performance on organizational performance in a supply chain context, *Supply Chain Management: An Internat. J.*, **13** (4) : 317-327.
- Gunasekaran, A., Patel, C. and Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment, *International J. Operations & Production Management*, **2** (1/2) : 71–87.
- Horvath, L. (2001). Collaboration: The key to value creation in supply chain management. *Supply Chain Management: An Internat. J.*, **6** (5) : 205–207.
- Kanda, A. and Deshmukh, S.G. (2008). Supply chain coordination: perspectives, empirical studies and research directions. *Internat. J. Production Economics*, **115** (2) : 316-335.
- Lee, H.L. (2000). Creating value through supply chain integration. *Supply Chain Management Review*, **4** (4) : 30–36.
- Maaz, M. A., Abad, A. and Ahmad, R. (2019). Service quality and customer satisfaction in organised and unorganised food service sector, *Internat. J. Commerce & Business Management*, **12** (2) : 58-66.
- Maaz, M.A. Ahmad, R. and Abad, A. (2020). Factors influencing purchase of milk through organized and unorganized channels, *International J. Management*, **11** (10) : 1186-1197.
- Madhavan, M., Krishnakumar, K. and Karpagam, K. (2020). Performance of dairy industry in India: An Analysis, *J. Xi'an University of Architecture & Technology*, **12** (6) : 1610-1620.
- McClellan, M. (2003). *Collaborative Manufacturing*. St Lucie Press, Delray Beach, FL
- Moazzam, M., Akhtar, P., Garnevska, E. and Marr, N. E. (2018). Measuring agri-food supply chain performance and risk through a new analytical framework: a case study of New Zealand dairy, *Production Planning & Control*, **29** (15): 1258-1274.
- Mor, R. S., Bhardwaj, A., Singh, S. and Arora, V. K. (2020). Exploring the factors affecting supply chain

- performance in dairy industry using exploratory factor analysis technique, *Internat. J. Industrial & Systems Engineering*, **36** (2): 248-265.
- Myerson, P.A. (2015). *Supply chain and logistics management*. New Jersey: Pearson Education.
- Olorunniwo, F., Hsu, M. K. and Udo, G. (2006). Service quality, customer satisfaction, and behavioral intentions in the service factory. *J. Services Marketing*, **20** (1): 59-72.
- Prakash, G. and Pant, R.R. (2013). Performance measurement of a dairy supply chain: A balance scorecard perspective, in *IEEE International Conference on Industrial Engineering and Engineering Management*, IEEE. 196-200
- Simatupang, T.M., Wright, A.C. and Sridharan, R. (2002). The knowledge of coordination for supply chain integration, *Business Process Management J.*, **8** (3): 289-308.
- Susanty, A., Bakhtiar, A., Purwaningsih, R. and Dewanti, D. F. (2017). Performance measurement of the relationship between farmers-cooperatives-industrial processing milk in a dairy supply chain: A balanced supply chain management scorecard approach, in *2017 IEEE International Conference on Industrial Engineering and Engineering Management*, IEEE,. 1387-1391pp.
- Van der Vorst, J. (2000). Effective food supply chains: Generating, modelling and evaluating supply chain scenarios. Doctoral thesis, Wageningen University.
- Widyaningrum, D. and Masruroh, N. A. (2012). Development of the sea fishery supply chain performance measurement system: A case study, *International J. Supply Chain Management*, **1** (3) : 20-32.
- Xu, L. and Beamon, B. M. (2006). Supply chain coordination and cooperation mechanisms: an attributebased approach. *J. Supply Chain Management*, **42**(1):4-12.

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