Asymmetry in Knowledge Management in Supply Chain Management

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ABSTRACT

The paper discusses the importance of knowledge sharing in supply chain management (SCM). From the literature reviews, from various reputed journals, we have identified a set of factors responsible for the immature knowledge management (KM) among supply chain partners in the food supply chain. Analysis followed in the paper is purely based on primary data collected from the survey conducted among experts and professionals on the effect of the identified parameters on the maturity level of KM in SCM. The results from the analysis clearly show the parameters that need to be considered by an organization to ensure a smooth flow of information across SC touch points which can further enhance the efficiency of food SC operations. In the future, if more detailed research is conducted in terms of larger sample size and collection of primary data from various other locations, more detailed insights can be drawn which can be used to implement the best knowledge sharing practices in the food supply chain.

Keywords: Knowledge Management, Food Supply Chain, Maturity Level, Efficiency.

INTRODUCTION:

Supply Chain Management deals with individuals or organizations who are directly or indirectly involved in fulfilling the needs of customers. It deals with the movement and storage of raw materials, work in process inventory and finished goods from the point of origin to the point of consumption. It also ensures a smooth flow of information, products and funds across the chain. It has become a significant factor in globalization and has become a core competency for many of the organizations. It deals with suppliers, manufacturers, distributors, retailers, customers and other stakeholders. Each of these members has different information to share which help them in achieving common goals. Sharing of information by the partners across SC nodes helps in better decision making, more visibility and increases profitability. For efficient management of supply chain, sharing of information among the partners of the supply chain is important. Knowledge sharing in the supply chain has become so important that it increases transparency and sustainability in the supply chain.

A food supply chain is more vulnerable to risks than others due to the type of goods it is handling. Food products are perishable and hence require more responsive SC to meet the objectives. For this to happen, SC partners should provide the right information at the right time to increase the visibility and efficiency of supply chains. However, most of the firms lack efficient knowledge sharing activities that impact the maturity level. The paper identifies such variables that contribute to immature knowledge management in food supply chains from the exploratory literature review. The paper also through a set of analysis determines the most crucial variables that need to be considered by the food industry to ensure the efficiency of knowledge management in their supply chain.

LITERATURE REVIEW:

Supply chain can be defined as all the activities involved in delivering a product from raw materials to the customer, including procurement of raw materials and parts, manufacturing and assembly, warehousing and inventory management, order entry and order management, distribution across channels, delivery to the customer and the information system to track all these activities (Douglas M. Lambert, 1998). The management of multiple relationships across the supply chain is being referred to as supply chain management (Rhonda R. Lummus, 1999). Supply Chain encompasses a number of functions from order placement till the delivery.

Knowledge is a belief that helps entities to take effective action. There can be both tacit and explicit types of knowledge. Tacit knowledge is spontaneous and requires less or no time to thought and helps determine how organizations make decisions (Jay Liebowitz, 1998). Explicit knowledge, on the other hand, is the technical or academic data or information that is documented like in manuals, mathematical expressions and patents and is made available to all the members of the organization (Smith, 2001). Knowledge Management (KM) deals with the creation, storage, distribution and implementation of organizational knowledge. It mainly consists of five stages; knowledge creation, acquisition, storage, dissemination and application (Nancy C. Shaw, 2003). The process of creating knowledge in an organization can be explained using Nonaka's dynamic knowledge creating process (Nonaka, 1994). The first step in the process is externalization wherein individuals are able to share their tacit assumptions with others usually within a team interaction. Externalized knowledge is later documented to make it available in the organizational level and is called combination. Documented knowledge will then be experienced by other members in the organization in the form of transit knowledge and is called internalization. The process of transferring transit knowledge from one individual to another within the organization is called socialization. This model is called the SECI model (Peter Y.T. Sun, 2006). KM is also considered as a tool that helps in determining, directing and providing the practices related with the knowledge required to achieve the strategies and objectives of the business and thereby generate value for the organization to acquire competence and capabilities (MONROY & FUENTES-PILA, 2009).

The role which KM has in SCM has been identified years back and many scholars have done their research in the field which supports its need. Knowledge acquisition activities, information distribution activities and shared meaning were associated with faster cycle time. A model was developed based on 58 strategic supply chains wherein all the suppliers involved are familiar with the focusing firm's supply chains. The model suggests that there is a strong link between knowledge and reduced cycle time. Managerial Implication of the model is suggesting certain tools for better supply chain management. The model developed was able to close the gap of what actually is known about supply chain and what else needs to be known (G. TOMAS M. HULT, 2004). There is an availability of timely information across various stages of the supply chain and hence is needed to effectively utilize the information for improving the performance. As timely access to supply chain information increases, competition in the marketplace increases which in turn erodes the profit margin. A framework by leveraging the advances in Information Technology has been proposed by (Piramuthu, 2005). The proposed Automated Supply Chain Configurer (ASCC) can be considered as an agent that resides at every node of the supply chain. At each node, the process starts by gathering information about the next process upstream. It filters the collected information and learns the patterns using certain algorithms. Knowledge in the knowledge base is updated periodically and once the information arrives from the downstream it associates patterns.

In SCM, explicit techniques and procedures are required for initiating Collaborative Planning Forecasting and Replenishment (CPFR) which involves the coordination of all the supply chain partners. Tacit knowledge on other hand helps in understanding internal policies. Lack of knowledge sharing between the touch points of a supply chain can significantly affect the overall performance. Hence it is required to integrate KM with SCM to get better results. Many examples help to understand this concept better. With the proper implementation of KM, an efficiency of the people in the organization can be improved. It can help them to identify various discounts available with the suppliers, capability to run what-if analysis before placing an order with the vendors and will be capable of integrating OEM promotion schemes with the online order (Nancy C. Shaw, 2003). Also, it was found in another research the importance of integrating the Agrifood Supply Chain (ASC) with Knowledge Management. In order to overcome the challenges of the 21st century, it is necessary to manage knowledge in ASC. Any of the existing descriptive and prescriptive models can be used for the purpose. Descriptive models characterize the nature of the phenomenon whereas Prescriptive models show the methodologies that must be followed for KM. Developing KM models for ASC is indeed required to provide safe and quality food by responding to the untimely and temporary changes of the world. However, ASC is facing certain challenges and it can be overcome by increasing the level of trust and communication between various touch points of the supply chain (MONROY & FUENTES-PILA, 2009).

A framework to understand better the importance of integrating supply chain management with knowledge management has been developed. The people who regularly face customers were surveyed and based on the analysis, knowledge models were created. These models were evaluated to identify critical success factors for effectively managing knowledge to ensure that the competitiveness of supply chains is met. With the data collection application of the existing conceptual model based on Nonaka's four-stage SECI model was tested. The study revealed that with supply chain becoming an unavoidable part in operations strategy the model is not suitable to the current SCM environment which needs a faster response to the market. There is indeed a need to integrate supply chain parameters into an eventual KM model for enhancing supply chain competitiveness. However, the study lacks a precise KM model of SCM that can address the challenges of the changing SC environment (Karine Evrad Samuel, 2011). A review of all the papers on the role of knowledge management in supply chain management showed the most common areas of SCM where KM is used are outsourcing, construction industry, new product development, decision support and risk management. Outsourcing activities emerge to be the most popular area where KM can be applied in the supply chain. It emphasizes the need for enhancing cooperation and trust to increase knowledge management process among business partners (Marianna Marra, 2012).

A conceptual model between the relations of knowledge in SMEs and their supply chains has also been formulated. The model is developed based on the dynamics of the enterprises' environment, their internal policies and different models identified in the literature. The supply chain is an interface between customers, manufacturers, dealers and suppliers. In order to gain the competitive position in this continuously changing environment, it is necessary to develop a knowledge model for the supply chain taking into account the external, internal and human resources linked to the process. It is also crucial for making managerial decisions in logistics and supply chain management as it has the best problem-solving capabilities. Most of the organizations have started using knowledge models like the SCOR model to reduce the complexity of the supply chain. Many prescriptive and descriptive models are existing in the market. The causal model developed has identified structure, knowledge and application as its building blocks and established them in each subsystem of the supply chain. It has taken maturity model developed by SEDESOL as the reference. The model developed represents the functional design, documentary and regulatory base that support the performance of tasks, concerning rules, policies, objectives and operating guidelines of the organization (Oscar Montano Arango, 2014).

Even though the performance of the supply chain can be increased by efficient knowledge management models there are certain problems associated with knowledge acquisition. Building a knowledge acquisition system is based on finding the types of knowledge. Modelling of knowledge types can act as a base to assist in solving SCM problems. Preparing innovative knowledge creation methods is a critical factor for enhancing competitive advantage. In a case study of food manufacturing firm, six kinds of supply chain partners namely supplier, manufacturer, warehouse staff, deliverer, retailer and customer were studied in order to examine the knowledge types and the role of these partners in the entire life-cycle. These partners determine the extent of the supply chain's embeddedness. The degree of embeddedness and engagement with the partners has a significant impact on the process like knowledge acquisition. Based on the responses collected from the partners a knowledge acquisition model has been developed which will assist in building a knowledge repository for any system. Since the model was based on the requirements proposed by the partners, it will help the decision maker to make the right decisions from the exact and right knowledge (Salim, 2013).

The supply chain has a crucial role in contemporary agriculture. Agri-food supply chain is more vulnerable to risks due to food perishability and requirements to the food supply chain. An Italian survey emphasizes the need for traceability to establish sustainability in the food supply chain. Better traceability can be established by considering factors like; information quality, governance issues, collaborative decision making, integrating supply chain partners, technology, people and cost (Francesco Zecca, 2014). Different approaches are being followed to analyze the state of knowledge management research in supply chain management. A study showed that the case study approach is the widely used methodology by the authors for investigating KM in supply chains. The main purpose of the research was to find out the most common methodology used for investigating the role of KM in SCM, which all SCM practices are addressed and which SC practices are associated with the creation, storage, transfer and application of knowledge. The research methodology followed consists of three phases; planning, conducting and documenting. It was found that the case study is the most common methodology followed by survey-based analysis and conceptual models respectively. Also, it showed that KM can be used for SC integration, SC strategy, product development, supplier management, Customer Relationship Management and SC learning. In order to achieve solid contribution to KM field in SC context, there is a need

for using replicable methodologies, resulting in reliable and usable data to implement KM frameworks (María del Rosario Pérez-Salazar, 2017).

In this emerging competitive world where integrating KM with SCM is considered as a competitive advantage for all the companies, there are managers who still don't have enough understanding of KM. In a survey conducted, KM was placed as an independent, intervening and moderate variable to understand its impact on the company's performance. Five other variables were also identified viz. company's performance, supply chain management practices, competitive advantage, organization culture and knowledge asymmetry. Results showed that Knowledge management is only a competitive advantage for the company's performance. It is the most important thing required to improve the company's performance. By using path analysis authors were able to find that direct impact of supply chain management, competitive advantage and organizational culture is higher than indirect impact through Knowledge Management on the company's performance. It also states that knowledge management is a bottleneck for the company's performance and other management functions (Steph SUBANIDJA, 2017). An empirical study has been conducted using the Delphi method with 29 supply chain experts to identify those factors. The study collected qualitative and quantitative data and identified 22 factors which were further grouped into six categories namely; Information Utilization, Power Structure, Business Processes, Legal, Culture and Technology Utilization. All these factors pose challenges to information sharing besides dyadic relationship across multi-tier supply chains (Joakim Kembro, 2017).

METHODOLOGY:

Problem Analysis:
"Mature process of KM adoption by the Supply Chain partners to enhance SC efficiency."
Supply chain information management is the most important aspect for managing the various aspects of the movement of materials and fulfilling the demand for the product or service in the market. However, the maturity of the knowledge management of the supply chain is not specified for an organization. Maturity model will give clear metrics for the measurement of the KM process maturity in the supply chain with various stakeholders at each node of the chain.

Objectives:
- To identify the variables which enable the knowledge sharing process for the mature KM process in an organization
- To identify factors that are restricting the knowledge sharing process across the various supply chain touch points.

Hypothesis:
Chi-Square Test:
Chi-Square test has been done to identify the relation between maturity level and the identified factors and there by determining the significance of each of them for the analysis.

Hypothesis 1:
H_o: There is no association between dependent variable maturity level and independent variable Power Asymmetry.
H_a: There is association between dependent variable maturity level and independent variable Power Asymmetry.
It determines the association between maturity level and power asymmetry, the fear among the partners to become completely dependent on others. It can make firms to fear losing their bargaining power.

Hypothesis 2:
H_o: There is no association between dependent variable maturity level and independent variable Information Quality.
H_a: There is association between dependent variable maturity level and independent variable Information Quality.
It determines how timely and reliable information affects the maturity level of KM in Supply chain. Without timeliness and reliability, information shared will be of less or no use to the receiver.

Hypothesis 3:
H_o: There is no association between dependent variable maturity level and independent variable Business Process.
H_a: There is association between dependent variable maturity level and independent variable Business Process.
Business process considers whether all the partners in the supply chain are aiming towards a common goal through standardized processes. Hypothesis identifies whether there is any relation between maturity level and business processes of a firm.

Hypothesis 4:
H_o: There is no association between dependent variable maturity level and independent variable Governance Issues.
H_a: There is association between dependent variable maturity level and independent variable Governance Issues.
Due to multiple levels in SC, there will be a lack of governance on how to control and direct the whole process. Hypothesis tests whether lack of governance have an association with maturity levels.

Hypothesis 5:
H_o: There is no association between dependent variable maturity level and independent variable Legal Aspects.
H_a: There is association between dependent variable maturity level and independent variable Legal Aspects.
Legal aspects deal with confidential information, legal framework, intellectual property rights and copyrights. Many firms fear to share information to partners external to the firm due to the risk involved in loss of confidential information.

Hypothesis 6:
H_o: There is no association between dependent variable maturity level and independent variable Technology Utilization.
H_a: There is association between dependent variable maturity level and independent variable Technology Utilization.
Technology utilization considers areas; linked IT systems and common platforms, standardized terminology, IT-maturity and standardized format for data-exchange.

Hypothesis 7:
H_o: There is no association between dependent variable maturity level and independent variable People Management.
H_a: There is association between dependent variable maturity level and independent variable People Management.
Opportunistic behaviors by the SC partners reduce the willingness to share information by others due to the risk of leakage of information.

Hypothesis 8:
H_o: There is no association between dependent variable maturity level and independent variable Collaborative Decision Making.
H_a: There is association between dependent variable maturity level and independent variable Collaborative Decision Making.
To ensure smooth flow of information among various touch points of supply chain, collaborative decision making is required. It involves people with different beliefs, culture and different goals.

Hypothesis 9:
H_o: There is no association between dependent variable maturity level and independent variable Cost.
H_a: There is association between dependent variable maturity level and independent variable Cost.
Partners may have different infrastructure in place to share the information that is not compatible and implementation of new IT systems involve huge capital investments.

Hypothesis 10:
H_o: There is no association between dependent variable maturity level and independent variable Supply side integration.
H_a: There is association between dependent variable maturity level and independent variable Supply side integration.
SC deals with suppliers at different levels; primary, secondary and tertiary to procure the raw materials. All the suppliers should be brought into the same platform to ensure smooth flow of information.

Hypothesis 11:
H_o: There is no association between dependent variable maturity level and independent variable Knowledge Asymmetry.
H_a: There is association between dependent variable maturity level and independent variable Knowledge Asymmetry.
The variation in knowledge sharing at different levels of the supply chain can have a negative impact on the smooth flow of information in supply chain. Hypothesis tests the association of maturity level with knowledge asymmetry.

ANOVA Test
Hypothesis 12:
H_o: Regression model is not fit for analysis
H_a: Regression model is fit for analysis

Data Collection:

From the literature reviews, we have identified a set of factors responsible for the immature knowledge management among supply chain partners in both local and global food supply chains. Primary data is collected from respondents based on a questionnaire formulated for the identified factors. The sample size of 60 has been identified which comprised of supply chain managers of FMCG, IT, Consulting, 3PL, Beverages and Spices companies in the eastern and western part of the world. The respondents also included academicians, domain experts and other business experts. The responses were collected on a Likert's scale of 1 to 5.

Descriptive statistics for the variables identified were analyzed from the responses. Crosstab analysis has been conducted to identify the repetition of variables with respect to the independent variable. Following which the chi-square test has been done to identify the association between the variables and the dependent variable. The test was conducted to know the variables that are significant for the analysis. After identifying the significant variables, the possibility of a regression model with the variables was examined. A regression equation has then been formulated to identify the exact factors responsible for different levels of maturity in the knowledge management process.

Identification of Variables:

All the variables which enable the knowledge sharing process for the mature KM process in organization identified from literature reviews are summarized below:

Table 1: Variables enabling Knowledge sharing

Authors	Variables
(Francesco Zecca, 2014)	Information Quality, Governance issues, Collaborative Decision making, Integrating supply chain partners, Technology, People and Cost.
(Steph SUBANIDJA, 2017)	Supply chain management practices, Organization culture and Knowledge asymmetry.
(Joakim Kembro, 2017)	Information Utilization, Power Structure, Business Processes, Legal, Culture and Technology Utilization.

FINDINGS AND DISCUSSION:

Independent and dependent variables considered for the analysis are as given below.

Table 2: Dependent and Independent Variables

Dependent Variable (X)	Independent Variables (Y)
Maturity level (M)	Power Asymmetry (PA) Governance Issues (G) Knowledge Asymmetry (K) Information Quality (I) Technology Utilization (T) Collaborative Decision Making (D) Supply Side Integration (S) Cost (C) Legal Aspects (L) Business Processes (B) People Management (P)

Crosstabs and chi-square tests:

(i)Hypothesis 1: Maturity Level and Power Asymmetry

As provided below, significant value of the chi-square test between maturity level and power asymmetry is 0.00, hence rejecting null hypothesis. Thus there is association between maturity level and power asymmetry.

Table 3: Chi-Square test between Maturity Level and Power Asymmetry Crosstab

		Power Asymmetry			Total
		2	3	4	
Maturity Level	2	0	14	0	14
	3	5	14	13	32
	4	3	0	9	12
	Total	8	28	22	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	26.508[a]	4	.000
Likelihood Ratio	36.505	4	.000
Linear-by-Linear-Association	4.470	1	.062
N of Valid cases	58		

a. 4 cells (44.4%) have expected count less than 5. The minimum expected count is 1.66

(ii)Hypothesis 2: Maturity Level and Information Quality
As provided below, significant value of the chi-square test between maturity level and information quality is 0.454, hence accepting null hypothesis. Thus there is no association between maturity level and information quality.

Table 4: Chi-Square test between Maturity Level and Information Quality Crosstab

		Information Quality				Total
		1	2	3	4	
Maturity Level	2	3	8	3	0	14
	3	3	20	6	3	32
	4	3	5	4	0	12
	Total	9	33	13	3	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	5.728[a]	6	.454
Likelihood Ratio	6.818	6	.338
Linear-by-Linear-Association	.123	1	.726
N of Valid cases	58		

a. 8 cells (66.7%) have expected count less than 5. Theminimum expected count is .62

(iii)Hypothesis 3: Maturity Level and Business Process
As provided below, significant value of the chi-square test between maturity level and business process is 0.097, hence accepting null hypothesis. Thus there is no association between maturity level and business process.

Table 5: Chi-Square test between Maturity Level and Business Process (Crosstab)

		Business Process			Total
		2	3	4	
Maturity Level	2	0	12	2	14
	3	9	19	4	32
	4	5	7	0	12
	Total	14	38	6	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	7.863[a]	4	.097
Likelihood Ratio	12.098	4	.017
Linear-by-Linear-Association	6.158	1	.013
N of Valid cases	58		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is 1.24

(iv)Hypothesis 4: Maturity Level and Governance Issues
As provided below, significant value of the chi-square test between maturity level and governance issues is 0.001, hence rejecting null hypothesis. Thus there is association between maturity level and governance issues.

Table 6: Chi-Square test between Maturity Level and Governance Issues Crosstab

		Governance Issues			Total
		3	4	5	
Maturity Level	2	14	0	0	14
	3	19	12	1	32
	4	3	6	3	12
Total		36	18	4	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	19.434[a]	4	.001
Likelihood Ratio	22.620	4	.000
Linear-by-Linear-Association	16.362	1	.000
N of Valid cases	58		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .83

(v)Hypothesis 5: Maturity Level and Legal Aspects
As provided below, significant value of the chi-square test between maturity level and legal aspects is 0.013, hence rejecting null hypothesis. Thus there is association between maturity level and legal aspects.

Table 7: Chi-Square test between Maturity Level and Legal Aspects Crosstab

		Legal Aspects			Total
		2	3	4	
Maturity Level	2	3	3	8	14
	3	0	3	29	32
	4	0	3	9	12
Total		3	9	46	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	12.629[a]	4	.013
Likelihood Ratio	11.787	4	.019
Linear-by-Linear-Association	3.860	1	.049
N of Valid cases	58		

a. 6 cells (66.7%) have expected count less than 5. The minimum expected count is .62

(vi)Hypothesis 6: Maturity Level and Technology Utilization
As provided below, significant value of the chi-square test between maturity level and technology

utilization is 0.004, hence rejecting null hypothesis. Thus there is association between maturity level and technology utilization.

Table 8: Chi-Square test between Maturity Level and Technology Utilization Crosstab

		Technology Utilization			Total
		2	3	4	
Maturity Level	2	10	2	2	14
	3	10	22	0	32
	4	5	7	0	12
	Total	25	31	2	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	15.413[a]	4	.004
Likelihood Ratio	16.041	4	.003
Linear-by-Linear-Association	.599	1	.439
N of Valid cases	58		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is .41

(vii)Hypothesis 7: Maturity Level and People Management

As provided below, significant value of the chi-square test between maturity level and people management is 0.328, hence accepting null hypothesis. Thus there is no association between maturity level and people management.

Table 9: Chi-Square test between Maturity Level and People Management (Crosstab)

		People Management		Total
		2	3	
Maturity Level	2	5	9	14
	3	13	19	32
	4	2	10	12
	Total	20	38	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	2.230[a]	2	.328
Likelihood Ratio	2.433	2	.296
Linear-by-Linear-Association	.895	1	.344
N of Valid cases	58		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.14

(viii)Hypothesis 8: Maturity Level and Collaborative Decision Making

As provided below, significant value of the chi-square test between maturity level and collaborative decision making is 0.111, hence accepting null hypothesis. Thus there is no association between maturity level and collaborative decision making.

Table 10: Chi-Square test between Maturity Level and Collaborative Decision Making (Crosstab)

		Collaborative Decision Making		Total
		3	4	
Maturity Level	2	6	8	14
	3	7	25	32
	4	1	11	12
	Total	14	44	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	4.405[a]	2	.111
Likelihood Ratio	4.483	2	.106
Linear-by-Linear-Association	4.223	1	.040
N of Valid cases	58		

a. 2 cells (33.03%) have expected count less than 5. The minimum expected count is 2.90

(ix)Hypothesis 9: Maturity Level and Cost

As provided below, significant value of the chi-square test between maturity level and cost is 0.000, hence rejecting null hypothesis. Thus there is association between maturity level and cost.

Table 11: Chi-Square test between Maturity Level and Cost (Crosstab)

		Collaborative Decision Making		Total
		2	4	
Maturity Level	2	14	0	14
	3	8	24	32
	4	0	12	12
Total		22	36	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	32.515[a]	2	.000
Likelihood Ratio	41.003	2	.000
Linear-by-Linear-Association	28.224	1	.000
N of Valid cases	58		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.56

(x)Hypothesis 10: Maturity Level and Supply Side Integration

As provided below, significant value of the chi-square test between maturity level and supply side integration is 0.007, hence rejecting null hypothesis. Thus there is association between maturity level and supply side integration.

Table 12: Chi-Square test between Maturity Level and Supply Side Integration (Crosstab)

		Collaborative Decision Making		Total
		2	3	
Maturity Level	2	3	11	14
	3	0	32	32
	4	0	12	12
Total		3	55	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	9.943[a]	2	.007
Likelihood Ratio	9.065	2	.011
Linear-by-Linear-Association	6.483	1	.011
N of Valid cases	58		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is .62

(xi)Hypothesis 11: Maturity Level and Knowledge Asymmetry

As provided below, significant value of the chi-square test between maturity level and knowledge asymmetry is 0.000, hence rejecting null hypothesis. Thus there is association between maturity level and knowledge asymmetry.

Table 13: Chi-Square test between Maturity Level and Knowledge Asymmetry (Crosstab)

		Collaborative Decision Making		Total
		2	4	
Maturity Level	2	14	0	14
	3	32	0	32
	4	5	7	12
	Total	51	0	58

Chi-Square Tests

	Value	df	Asymp.Sig (2-sided)
Pearson Chi-Square	30.516ª	2	.000
Likelihood Ratio	26.422	2	.000
Linear-by-Linear-Association	18.727	1	.000
N of Valid cases	58		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is 1.45

Now ideally based on the chi-square test conducted for regression, the factors which are insignificant; Information Quality, Business Process, People Management and Collaborative Decision Making should not be considered. However, we have considered them based on the domain knowledge we are having in the field.

All the eleven variables identified were fed into regression model against the dependent variable maturity level. The R square value of 0.748 indicates 74% variation can be explained by the identified factors.

Table 14: Regression Output (Model Summary)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865ª	.748	.687	.377

a. **Predictors:** (Constant), People Management, Technology Utilization, Legal Aspects, Information Quality, Supply side Integration, Knowledge Asymmetry, Business Process, Collaborative Decision Making, Governance Issues, Cost. Power Asymmetry

Hypothesis 12: Checking the eligibility of the regression model based on Anova test
The anova test resulted in a significance value of 0.00, hence we have rejected the null hypothesis and concluded that the regression model is a good fit.

Table 15: ANOVA Table

ANOVAª						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.384	11	1.762	12.381	.000ᵇ
	Residual	6.547	46	.142		
	Total	25.931	57			
a. Dependent Variable: Maturity Level						
b. Predictors: (Constant), Knowledge Asymmetry, Information Quality, Supply Side Integration, Legal Aspects, People Management, Business Process, Technology Utilization, Collaborative Decision Making, Governance Issues, Cost, Power Asymmetry						

Among the eleven independent variables identified, Power Asymmetry (P) and Governance Issues (G) reported a very high collinearity index and hence were not considered for forming the regression equation, even though these variables were significant for maturity level.

Table 16: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-1.786	1.179		-1.516	0.136		
Power Asymmetry	-0.448	0.211	-.0454	-2.126	0.039	0.121	8.294
Information Quality	-0.080	0.076	-0.089	-1.053	0.298	0.764	1.308
Governance Issues	0.569	0.210	0.528	2.717	0.009	0.145	6.895
Legal Aspects	0.097	0.112	0.079	0.867	0.391	0.664	1.505
Technology Utilization	-0.127	0.111	-0.106	-1.149	0.257	0.649	1.540
Collaborative Decision Making	-0.006	0.174	-0.004	- 0.037	0.971	0.442	2.263
Cost	0.386	0.076	0.560	5.091	0.000	0.454	2.203
Supply Side Integration	0.666	0.274	0.220	2.427	0.019	0.665	1.504
Knowledge Asymmetry	0.338	0.105	0.330	3.211	0.002	0.521	1.920
Business Process	0.265	0.172	0.227	1.542	0.130	0.254	3.933
People Management	-0.122	0.116	-0.087	1.055	0.297	0.809	1.237

From the analysis, regression equation (Eq. 1) can be formed as;

$$M = -1786 - 0.080 I + 0.097 L - 0.127 T - 0.006 D + 0.386 C + 0.666 S + 0.338 K + 0.265 B - 0.122 P. \text{ --- (Eq. 1)}$$

It indicates that variables information quality, technology utilization, collaborative decision making and people management have a negative impact on the maturity levels of the organization. In other words, if these factors were made to increase by a unit 'x', it will decrease the maturity level by 'x'. Thus organizations should ensure that these variables are carefully managed to avoid disparity in information sharing and hence maintain the maturity level.

So, from the conclusive research it is evident that if the firms take measures to improve the quality of information, efficient utilization of technology, emphasize on collaborative decision making where all SC partners are involved and through efficient management of people resources they will be able to achieve maturity in their knowledge management process in food supply chain.

CONCLUSION:

Supply chain management will help firms to get a competitive advantage if there is an appropriate sharing of knowledge among various touch points. Knowledge management has a positive impact in enhancing supply chain performances. It increases the transparency, sustainability and improves decision making in the supply chain. From various literature reviews, a set of variables have been identified that affects knowledge asymmetry in both local and global supply chains. The analysis which was performed on these variables clearly depicts that four among eleven variables; information quality, technology utilization, collaborative decision making and people management impacts the maturity levels of knowledge management in the food industry. Hence organizations need to take appropriate measures to manage these variables to avoid disparity in knowledge sharing among supply chain partners. It helps to achieve maturity in the knowledge management process of the food supply chain. In the future, if more detailed research is conducted in terms of larger sample size and collection of primary data from various other locations, more detailed insights can be drawn which can be used to implement the best knowledge sharing practices in the food supply chain. It can also help to consider more variables and can cluster them on the basis of similarities.

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REFERENCES:

Almuiet, M. Z., & Salim, J. (2013). Knowledge flow in supply chain manufacturing: Case study in food manufacturing firm. *Procedia Technology*, *11*, 463-470.

Arango, O. M., Armenta, J. R. C., Quiroz, I. A. P., Gonzalez, J. G., Benitez, M. A. M., & Gomez, H. R. (2014). A Model for Conceptualizing the Knowledge in Supply Chain Relationships. Case Study: Manufacturing Smes in the. *European Scientific Journal, ESJ*, 10 (19).

del Rosario Pérez-Salazar, M., Lasserre, A. A. A., Cedillo-Campos, M. G., & González, J. C. H. (2017). The role of knowledge management in supply chain management: A literature review. *Journal of Industrial Engineering and Management*, *10*(4), 711-788.

Hult, G. T. M., Ketchen Jr, D. J., & Slater, S. F. (2004). Information processing, knowledge development, and strategic supply chain performance. *Academy of management journal*, *47*(2), 241-253.

Kembro, J., Näslund, D., & Olhager, J. (2017). Information sharing across multiple supply chain tiers: A Delphi study on antecedents. *International Journal of Production Economics*, *193*, 77-86.

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: implementation issues and research opportunities. *The international journal of logistics management*, *9*(2), 1-20.

Liebowitz, J., & Beckman, T. J. (1998). *Knowledge organizations: What every manager should know*. CRC press.

Lummus, R. R., & Vokurka, R. J. (1999). Defining supply chain management: a historical perspective and practical guidelines. *Industrial Management & Data Systems*, *99*(1), 11-17.

Marra, M., Ho, W., & Edwards, J. S. (2012). Supply chain knowledge management: A literature review. *Expert systems with applications*, *39*(5), 6103-6110.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization science*, *5*(1), 14-37.

Piramuthu, S. (2005). Knowledge-based framework for automated dynamic supply chain configuration. *European Journal of Operational Research*, *165*(1), 219-230.

Rodriguez, M., Fuentes-Pila, J., Martínez, S., Velasco, J., & Morris, A. (2009). Knowledge management in the food supply chain. In *System dynamics and innovation in food networks 2009. Proceedings of the 3rd International European Forum on system dynamics and innovation in food networks, Innsbruck-Igls, Austria, 16-20 February, 2009* (pp. 359-367). Universität Bonn-ILB.

Samuel, K. E., Goury, M. L., Gunasekaran, A., & Spalanzani, A. (2011). Knowledge management in supply chain: An empirical study from France. *The Journal of Strategic Information Systems*, *20*(3), 283-306.

Shaw, N. C., Meixell, M. J., & Tuggle, F. D. (2003, January). A case study of integrating knowledge management into the supply chain management process. In *System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on* (pp. 10-pp). IEEE.

Smith, E. A. (2001). The role of tacit and explicit knowledge in the workplace. *Journal of knowledge Management*, *5*(4), 311-321.

Subanidja, S., & Hadiwidjojo, D. (2017). The influence of knowledge management "bottleneck" on company's performance. *Management & Marketing*, *12*(3), 402-415.

Sun, P. Y., & Scott, J. L. (2006). Process level integration of organisational learning, learning organisation and knowledge management. *International Journal of Knowledge and Learning*, *2*(3-4), 308-319.

Zecca, F., & Rastorgueva, N. (2014). Supply Chain Management and Sustainability in Agri-Food System: Italian Evidence. *Journal of Nutritional Ecology and Food Research*, *2*(1), 20-28.

TABLES:

Table No.	Description
Table 1	Variables enabling Knowledge sharing
Table 2	Dependent and Independent Variables
Table 3	Chi-Square test between Maturity Level and Power Asymmetry
Table 4	Chi-Square test between Maturity Level and Information Quality
Table 5	Chi-Square test between Maturity Level and Business Process
Table 6	Chi-Square test between Maturity Level and Governance Issues
Table 7	Chi-Square test between Maturity Level and Legal Aspects
Table 8	Chi-Square test between Maturity Level and Technology Utilization
Table 9	Chi-Square test between Maturity Level and People Management
Table 10	Chi-Square test between Maturity Level and Collaborative Decision Making
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Table 12	Chi-Square test between Maturity Level and Supply Side Integration
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Table 14	Regression Output
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