

Managing Global Software Projects through knowledge sharing – A Case Study Project with reference to co-located and globally-distributed software teams

Balaji P

Abstract - The purpose of this research paper is to propose a knowledge sharing framework to manage software projects where employees working in different work location. To support the arguments made based on review literature, the paper presents the holistic framework of knowledge sharing in a software development company and also provides a model to solve the problem of knowledge sharing objections. The paper then applies the framework to study the existence of knowledge sharing process in a software development company to examine the effectiveness of knowledge sharing.

Index Terms - Global Project Management Through Knowledge Sharing, Knowledge sharing in organisations, Knowledge sharing in software development industry, organizational culture in knowledge sharing, awareness, trust, willingness, knowledge sharing, project management and knowledge sharing.



1. INTRODUCTION

Due to a changing business environment today, organisations are facing challenges of global competitiveness. Furthermore, organisations are confronted more and more with issues such as fast technological changes, product lifecycle shortened, downsizing, and high market volatility. In order to cope with these challenges, organizations need to be able to manage highly distributed diversified knowledge. Challenges rely on the identification of crucial knowledge that improves the business process. Knowledge is central but even more so is the understanding of the knowing process, and the learning and knowledge transfer/sharing process. Companies understanding the need to harness knowledge are aware about the crucial issue of creating a work environment that fosters knowledge sharing mechanisms and learning capabilities within and across organisations. It is well recognized that knowledge-sharing mechanisms are highly complex processes to promote in the organization. Indeed knowledge-sharing hostility is perceived rather as a phenomenon that widely dominates organizational reality.

The biggest challenge to developing a global delivery system is getting all team members to work efficiently and effectively together. Sharing knowledge and expertise is crucial in any team and in a team where members work in different countries.

2. NEED FOR THE STUDY

The biggest challenge to developing a global delivery system is getting all team members to work efficiently and effectively together. Sharing knowledge and expertise is crucial in any team, and in a team where members work in different countries and time zones and speak different languages, communication is not something that can be left to chance.

Previous studies focused on the knowledge sharing which is very generic and there were no studies conducted specific to growing software development industry. The researcher identified this as an important research gap, and researcher focused efforts in this direction. The research efforts are motivated by the above identified research gaps and the researcher decided to study how to manage global software projects through knowledge sharing by conducting a case study project with reference to co-located and globally-distributed software team.

Knowledge sharing within projects, across projects, and over time can improve both the efficiency and effectiveness of project management. However, it is not easy to do so. There are many types of knowledge and knowledge sharing methods. Further, many factors can encourage or inhibit sharing. The large number of possible combinations

• Balaji P is an research student at Vinayaka Missions University(Phd In Management) y, Salem, Tamil Nadu, India E-mail: bangalorebalaji@yahoo.com

of knowledge types, sharing methods, and affecting factors has to be analysed and understood, and the right methods deployed utilization and continuous creation of knowledge are the most important managerial challenges organizations face today. While the technology for collecting, storing, and accessing information continues to grow exponentially, the ability to effectively and efficiently use this information to enhance job performance, as well as deliver quality products and services remains elusive. The social challenge of fostering human interaction and Knowledge Sharing (KS) to encourage thinking rather than sophisticated copying remains a constant.

The management challenge is to create an environment that truly values KS. The personal challenge--often downplayed--is to be open to the ideas of others, willing to share ideas, and maintain a thirst for new knowledge. Knowledge in organizations manifests itself in one of two forms-explicit and tacit. Explicit knowledge can be easily articulated, captured, and transferred. Tacit knowledge is intangible and not easily transferable, and therein the problem exists. How do we share and transfer the tacit knowledge that resides in an organization.

3. LITERATURE REVIEW

It is well recognised today that knowledge is one of the most competitive resource for the dynamic global business environment (Sharif, 2005). Indeed, in recent years companies have strongly focused on organising creating, transferring, searching, sharing Knowledge under the roof so-called Knowledge Management (Hildreth, 2002).

On the other side, the multidisciplinary academic world such as philosophy, sociology, computer sciences have generated a large amount of publications on various perspectives and dimensions of knowledge management (Davenport, 1996, Davis, 2002). It is usually agreed that there is no common definition of knowledge but let's recall some of the popular definitions. "Knowledge is justified true belief that increases an individual's capacity to take action" (Ayer, 1956). Davenport (2000) defines knowledge as "a fluid mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information". According to (Brooking, 1999) knowledge is defined "as information in context with understanding to applying that knowledge".

The wide-based knowledge definitions highlights there are several forms of knowledge; tacit, explicit, implicit and systemic knowledge at the individual, group and organisational levels (Davenport, 2000, Dixon, 2002a, Polanyi, 1958, Nonaka, 1995, Inkpen, 1996). Explicit knowledge has a tangible dimension that can be easily captured, codified and communicated. It and can be shared through discussion or by writing it down and stored into repositories, documents, notes, etc. Examples might include a telephone directory, an instruction manual, or a report of research findings. In contrast, tacit knowledge is linked to personal perspectives, intuition, emotions, beliefs,

know-how, experiences and values. It is intangible and not easy to articulate, so it tends to be shared between people through discussion, stories and personal interactions. The management of explicit or tacit knowledge consists of performing one or several of the knowledge processes such as transferring, creating, integrating, combining and using knowledge. It is acknowledged that knowledge sharing is a nebulous concept very important for harnessing knowledge (Petersen, 2002, little, 2002) and thus enquires a holistic approach. Studies have focused either on knowledge sharing inter-organisations (Husman, 2001) or inter-units in a firm (Davis, 2002).

Knowledge sharing is not well defined in the literature partially because the research area has not been very active. Knowledge sharing has been defined as providing one's knowledge to others as well as receiving knowledge from others (Dixon, 2002b, Davenport, 2000, Bircham- Connolly, 2005). A more pragmatic description of knowledge sharing is "the process through which one unit is affected by the experience of another" (Argote, 2003). We adopt the following definition of (Willem, 2002), "Knowledge sharing process is defined as exchange of knowledge between at least two parties in a reciprocal process allowing reshaping and sense-making of the knowledge in the new context".

Today, many organisations are concerned about how organizational members share their knowledge and accordingly have set up some incentives to motivate them to make their knowledge available to the organisation or to retrieve knowledge stored in the corporate repositories when needed (Gupta, 2004).

The literature study shows us that they are several models for knowledge sharing (Petersen, 2002). The sharing knowledge forms with direct interaction between people or indirect interaction through the document creation. However, analysis of knowledge sharing practices shows that reluctance to share is dominating the organisational reality (Husted, 2002, Willem, 2003).

Factors affecting the behaviour of knowledge sharing have been quite heavily investigated (Wasko, 2000, Ardichvili, 2003). However, most of studies have focused either on social or technological dimensions. Few studies integrating the both dimensions have been conducted (Fu, 2005).

4. GAPS IN THE LITERATURE

From the review of the literature, it is possible to draw some overall conclusions:

1. Knowledge management is one of the key areas for sustained support, enhanced business and to be on top of the client's competitors.
2. There are several forms of knowledge; tacit, explicit, implicit and systemic knowledge at the individual, group and organisational levels.
3. How can we empower our teams to confidently execute projects end to end? What prevents us from executing flawlessly?
4. What barriers exist to ensuring a proper and on-going flow of knowledge during the project's execution?
5. Improving knowledge transfer between offshore

and onsite project management

6. Some people object to sharing as they feel that others will steal their ideas that reward rightly theirs. This is a fallacy. Knowledge sharing isn't about blindly sharing everything; giving away your ideas; or being open about absolutely everything. You still need to exercise judgment

5. OBJECTIVES

The main objective of the study is to measure the existence of the knowledge sharing process and effectiveness of knowledge sharing process for managing global software projects and the following research objectives are proposed:

1. To study the knowledge sharing process of IT companies (percentage analysis at the preliminary stage)
2. To identify the contribution of employees (Offshore / Onshore) in the knowledge sharing process and effectiveness of knowledge sharing (T-test)
3. To find the influences of organizational elements of IT companies on the knowledge sharing process and effectiveness of knowledge sharing (ANOVA)
4. To classify the perception of employees on knowledge sharing process and effectiveness of knowledge sharing in the organization (Cluster test)
5. To ascertain the association between various organizational elements and the knowledge sharing process and effectiveness of knowledge sharing (Chi-square analysis)
6. To establish the relationship between knowledge sharing process and effectiveness of knowledge sharing to construct an empirical model to sharply estimate the successful knowledge sharing process and effective knowledge sharing (Discriminant analysis)

6. KEY STAGES OF THE MODEL

The first stage is to identify demographic and organizational variable like work location, age, gender, designation and experience of the employees.

Secondly stage, it is necessary to identify the knowledge sharing elements like knowledge sharing with internal team members, knowledge sharing with co-located team members, knowledge sharing with non-team members, share knowledge on general overviews, share knowledge on specific requirements, share knowledge on process techniques, share knowledge on progress reports, share knowledge on results, communication frequency, job security and recognize knowledge as assert.

Third stage, it is necessary to identify effectiveness of knowledge sharing like, Improving competitive advantage, Improving customer focus, Innovations, Inventory reduction, Employee development, Cost reduction, Revenue growth, Better decision-making, Intellectual property rights, Faster response to key issues, Improving quality and Improving delivery

7. METHODS AND MATERIAL

The biggest challenge to developing a global delivery system is getting all team members to work efficiently and

effectively together. Sharing knowledge and expertise is crucial in any team, and in a team where members work in different countries and time zones and speak different languages, communication is not something that can be left to chance.

The following hypotheses were framed for the research study.

Hypothesis 1: There is no significant influence of contribution of employees in the knowledge sharing process

Hypothesis 2: There is no significant influence of contribution of employees in the effectiveness of knowledge sharing

Hypothesis 3: There is no significant influence of the organizational elements of IT companies on knowledge sharing process

Hypothesis 4: There is no significant influence of the organizational elements of IT companies on effectiveness of knowledge sharing process

Hypothesis 5: The perception of employees do not differ with respect to knowledge sharing process

Hypothesis 6: The perception of employees do not differ with respect to effectiveness of knowledge sharing process

Hypothesis 7: There is no significant association between organizational elements and knowledge sharing process

Hypothesis 8: There is no significant association between organizational elements and effectiveness of knowledge sharing

Hypothesis 9: There is no significant relationship between knowledge sharing process and the effectiveness of knowledge sharing.

A sample of 300 respondents in total has been selected to conduct case study on managing global software projects through knowledge sharing.

A. Collection of Primary Data

The primary data were collected through a survey conducted using questionnaire and interview methods.

B. Collection of Secondary Data

The secondary data's were collected from Books, Magazines, News Papers, Reports prepared by research scholars, Internet, various National and International Journals.

C. Nature of Research

It is basically a case study based research – This involves forming a group to study their cultural behaviour, collection of data for testing hypotheses and answering the questions concerning the current status of the subject of the study. This study determines and reports the way things are. Among the other things, the present study provides a report of what has happened and what is happening

D. Pilot Study and Pre-Testing

A pilot study was conducted during the month of January 2008. In this regard nearly 60 questionnaires were distributed and all were collected back as completed

questionnaires. On the basis of doubts raised by the respondents, the questionnaire was redrafted to its present form.

8. LIMITATIONS OF THE STUDY

1. The study is limited to focus on the Managing Global Software Projects in a selected IT company. The result of this study is applicable only to the IT companies.
2. The study is confined to only the eleven knowledge sharing elements and twelve effectiveness of knowledge sharing elements, Key stages of the model for software development company, though there are many more elements or subsystems in practice.
3. The study was based on a systematic sampling of 300 respondents and their responses might be passive or impulsive, purely based on their experience and mood which is likely to change instantly.
4. The study is based on the perception of the project managers, project leads and software engineers.

9. DISCRIMINANT ANALYSIS OF KNOWLEDGE SHARING MODEL

The K-means cluster analysis is applied to classify the respondents on the basis of knowledge sharing elements and effective knowledge sharing in a selected company. This clearly identified the existence of three predominant heterogeneous groups with different characteristic features. The associations among them are also verified and in this juncture it is important to note the cluster justification and number of clusters is required with mathematical proof, therefore a suitable and appropriate statistical tool discriminate analysis is used. It empirically gives out the results to construct the knowledge sharing model in global software projects.

A. Cluster justification of knowledge sharing elements

The three clusters "Gregarious employees", "Saturated employees", "Unenthusiastic employees" of knowledge sharing elements are justified through the application of discriminant analysis with the following results.

TABLE I - TESTS OF EQUALITY OF GROUP MEANS FOR CLUSTER JUSTIFICATION OF KNOWLEDGE SHARING ELEMENTS

	Wilks' Lambda	F	df1	df2	Sig.
Q3 (KS with internal team members)	.878	20.566	2	297	.000
Q4 (KS with co-located team members)	.972	4.207	2	297	.016
Q5 (KS with non-team members)	.983	2.627	2	297	.074
Q6 (Share knowledge on general overviews)	.911	14.419	2	297	.000
Q7 (Share knowledge	.873	21.546	2	297	.000

on specific requirements)					
Q8 (Share knowledge on process techniques)	.996	.538	2	297	.584
Q9 (Share knowledge on progress reports)	.867	22.717	2	297	.000
Q10 (Share knowledge on results)	.754	48.450	2	297	.000
Q11 (Communication frequency)	.944	8.773	2	297	.000
Q13 (Job Security)	.776	42.960	2	297	.000
Q14 (Recognize knowledge as assert)	.499	149.235	2	297	.000

Source: computed

TABLE - II TEST RESULTS OF EQUALITY OF GROUP MEANS FOR CLUSTER JUSTIFICATION OF KNOWLEDGE SHARING ELEMENTS

Box's M	213.180
F Approx.	1.529
df1	132
df2	209463.328
Sig.	.000

Tests null hypothesis of equal population covariance matrices.

Source: computed

From the above table I and II it is found that the eleven variable of elements possessed significant F value except for knowledge sharing with non team members and knowledge sharing on process techniques which are statistically significant at 5% level. This shows that the F values 20.566, 4.207, 14.419, 21.546, 22.717, 48.450, 8.773, 42.960, 149.235 are significant in proving the contribution of nine variables classifying the respondent perception. It also implies the responded do not differ in their opinion on sharing of knowledge with non team members as well as process techniques and CMMI methods and other testing procedures. They do not discriminant the employee's perception. It is further confirmed by the box M test with F value 1.529 and the M value 2.13180. These values are statistically significant in proving the contribution of nine variables in the formation of clusters. It is followed by two discriminant functions which are used as the tool to classify the sample unit.

TABLE-III EIGENVALUES OF KNOWLEDGE SHARING ELEMENTS

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1.881(a)	56.9	56.9	.808
2	1.423(a)	43.1	100.0	.766

a First 2 canonical discriminant functions were used in the analysis.

Source: computed

TABLE-IV WILKS' LAMBDA OF KNOWLEDGE SHARING ELEMENTS

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	.143	567.433	22	.000
2	.413	258.416	10	.000

Source: computed

From the above table III and IV it is found that a two discriminant function with individual variances 56.9, 43.1 and canonical coloration values 0.808 and 0.766 are statistically significant. The existence of these two function are further consolidated further through Wilks' Lambda value 0.143 and 0.413 with high statistically significant. This per formally concludes the two discriminant functions are useful in identifying different characteristics of the clusters.

The following table generates the discriminant function for the knowledge sharing and they are explicitly written as Z1 and Z2

TABLE-V STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS OF KNOWLEDGE SHARING ELEMENTS

	Function	
	1	2
Q3 (KS with internal team members)	.234	.504
Q4 (KS with co-located team members)	.025	.272
Q5 (KS with non-team members)	.086	.065
Q6 (Share knowledge on general overviews)	-.323	.243
Q7 (Share knowledge on specific requirements)	-.238	.407
Q8 (Share knowledge on process techniques)	.019	.003
Q9 (Share knowledge on progress reports)	-.025	.527
Q10 (Share knowledge on results)	-.481	.554
Q11 (Communication frequency)	.278	.210
Q13 (Job Security)	-.254	.620
Q14 (Recognize knowledge as assert)	.929	.045

Source: computed

The following structure matrix indicates the significance of the variables.

TABLE-VI STRUCTURE MATRIX OF KNOWLEDGE SHARING ELEMENTS

Function

	1	2
Q1	.729(*)	-.064
Q6	-.192(*)	.139
Q1	-.173	.405(*)
Q1	-.273	-.362(*)
Q9	-.041	.324(*)
Q7	-.084	.304(*)
Q3	.128	.275(*)
Q1	.109	.161(*)
Q4	-.003	-.141(*)
Q5	.047	.098(*)
Q8	.007	-.050(*)

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions Variables ordered by absolute size of correlation within function.

* Largest absolute correlation between each variable and any discriminant function

Source: computed

$$Z1=0.234xQ3+0.025xQ4+0.086xQ5-0.323xQ6-0.238xQ7+0.019xQ8-0.025xQ9-0.481xQ10+0.278xQ11-0.254xQ13+0.929xQ14$$

The respective questions are replaced with values
 $Z1=0.234x1+0.025x1+0.086x1-0.323x5-0.238x1+0.019x1-0.025x1-0.481x1+0.278x1-0.254x1+0.929x5$

$$Z1=2.674$$

The second discriminant function for the knowledge sharing are calculated as follows

$$Z2=0.504xQ3-0.272xQ4+0.065xQ5+0.243xQ6+0.407xQ7+0.003xQ8+0.527xQ9-0.554xQ10+0.210xQ11+0.620xQ13-0.045xQ14$$

$$Z2=0.504x5-0.272x5+0.065x5+0.243x1+0.407x5+0.003x5+0.527x5-0.554x5+0.210x5+0.620x5-0.045x1$$

$$Z2=7.748$$

This numerical enumeration sharply estimates the knowledge sharing process situation through the responses of 300 employees. The following in equality.

$$2.674 < Z < 7.748$$

Indicates the limitations for knowledge sharing process. The numerical analysis clearly says that the knowledge

sharing process is perfect among the employees if the z values lies between 2.674 and 7.748. Any z value beyond these numerical limitation tells about a poor knowledge sharing process in the perception of employees.

B. Cluster justification of effectiveness of knowledge sharing

The three clusters "Dynamic participants", "Saturated participants", "Moderate participants" of effectiveness of knowledge sharing elements are justified through the application of discriminant analysis with the following results.

TABLE-VII TESTS OF EQUALITY OF GROUP MEANS OF KNOWLEDGE SHARING EFFECTIVENESS

	Wilks' Lambda	F	df1	df2	Sig.
Q25A (Improving competitive advantage)	.771	44.153	2	297	.000
Q25B (Improving customer focus)	.900	16.477	2	297	.000
Q25C (Innovations)	.905	15.522	2	297	.000
Q25D (Inventory reduction)	.938	9.754	2	297	.000
Q25E (Employee development)	.873	21.580	2	297	.000
Q25F (Cost reduction)	.857	24.682	2	297	.000
Q25G (Revenue growth)	.692	66.115	2	297	.000
Q25H (Better decision-making)	.910	14.670	2	297	.000
Q25I (Intellectual property rights)	.985	2.255	2	297	.107
Q25J (Faster response to key issues)	.788	39.955	2	297	.000
Q25K (Improving quality)	.971	4.376	2	297	.013
Q25L (Improving delivery)	.968	4.864	2	297	.008

Source: computed

TABLE-VIII TEST RESULTS OF KNOWLEDGE SHARING EFFECTIVENESS

Box's M	143.253
F Approx.	.865
df1	156
df2	207807.590
Sig.	.887

Tests null hypothesis of equal population covariance matrices.

Source: computed

From the above table 5.81 and 5.82 it is found that the twelve elements possessed significant F value except for the Intellectual property rights which are statistically significant at 5% level. This shows that the F values 44.153, 16.477, 15.522, 9.754, 21.580, 24.682, 66.115, 14.670, 39.955, 4.376, 4.864 are significant in proving the contribution of eleven variables of variables classifying the respondent perception. It also implies the responded do not differ in their opinion on effectiveness of knowledge sharing with Improving competitive advantage, Improving customer focus, Innovations, Inventory reduction, Employee development, Cost reduction, Revenue growth, Better decision-making, faster response to key issues, improving quality and improving delivery. They do not discriminant the employee's perception. It is further confirmed by the box M test with F values 0.865 and the M value 143.253. These values are statistically significant in proving the contribution in the formation of clusters. It is followed by two discriminant functions which are used as the tool to classify the sample unit.

TABLE-IX EIGENVALUES OF KNOWLEDGE SHARING EFFECTIVENESS

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1.882(a)	54.6	54.6	.808
2	1.568(a)	45.4	100.0	.781

a First 2 canonical discriminant functions were used in the analysis.

Source: computed

TABLE-X WILKS' LAMBDA OF KNOWLEDGE SHARING EFFECTIVENESS

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	.135	583.474	24	.000
2	.389	274.908	11	.000

Source: computed

From the above table 5.83 and 5.84 it is found that a two discriminant function with individual variances 54.6, 45.4 and canonical coloration values 0.808 and 0.781 are statistically significant. The existence of these two function are further consolidated further through Wilks lamda value 0.135 and 0.389 with high statistically significant. This per formally concludes the two discriminant functions are useful in identifying different characteristics of the clusters.

The following table generates the discriminant function for the knowledge sharing and they are explicitly written as Z1

TABLE-XI STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS OF KNOWLEDGE SHARING EFFECTIVENESS

	Function	
	1	2
Q25A (Improving competitive advantage)	.798	.312
Q25B (Improving customer focus)	.309	.307
Q25C (Innovations)	.127	-.428
Q25D (Inventory reduction)	-.219	.423

Q25E (Employee development)	.574	.236
Q25F (Cost reduction)	.474	-.505
Q25G (Revenue growth)	-.145	-.813
Q25H (Better decision-making)	-.064	.494
Q25I (Intellectual property rights)	.171	.062
Q25J (Faster response to key issues)	.805	-.211
Q25K (Improving quality)	-.270	.092
Q25L (Improving delivery)	.187	.060

Source: computed

TABLE-XII STRUCTURE MATRIX OF KNOWLEDGE SHARING EFFECTIVENESS

	Function	
	1	2
Q25A	.377(*)	.138
Q25J	.357(*)	-.138
Q25E	.271(*)	.068
Q25F	.246(*)	-.183
Q25L	.127(*)	.039
Q25K	-.114(*)	.057
Q25I	.084(*)	.034
Q25G	-.029	-.532(*)
Q25C	.036	-.255(*)
Q25H	-.030	.249(*)
Q25B	.153	.206(*)
Q25D	-.059	.194(*)

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions Variables ordered by absolute size of correlation within function.

* Largest absolute correlation between each variable and any discriminant function

Source: computed

$$Z1 = 0.798 \times Q25A + 0.309 \times Q25B + 0.127 \times Q25C - 0.219 \times Q25D + 0.574 \times Q25E + 0.474 \times Q25F - 0.145 \times Q25G - 0.064 \times Q25H + 0.171 \times Q25I + 0.805 \times Q25J - 0.270 \times Q25K + 0.187 \times Q25L$$

The respective questions are replaced with values

$$Z1 = 0.798 \times 5 + 0.309 \times 1 + 0.127 \times 1 - 0.219 \times 1 + 0.574 \times 5 + 0.474 \times 5 - 0.145 \times 1 - 0.064 \times 1 + 0.171 \times 5 + 0.805 \times 5 - 0.270 \times 5 + 0.187 \times 5$$

$$Z1 = 13.703$$

$$Z2 = 0.312 \times Q25A + 0.307 \times Q25B - 0.428 \times Q25C + 0.423 \times Q25D + 0.236 \times Q25E - 0.505 \times Q25F - 0.813 \times Q25G + 0.494 \times Q25H + 0.062 \times Q25I - 0.211 \times Q25J + 0.092 \times Q25K + 0.060 \times Q25L$$

$$Z2 = 0.312 \times 1 + 0.307 \times 5 - 0.428 \times 5 + 0.423 \times 5 + 0.236 \times 1 - 0.505 \times 1 -$$

$$0.813 \times 5 + 0.494 \times 5 + 0.062 \times 1 - 0.211 \times 1 + 0.092 \times 1 + 0.060 \times 1$$

$$Z2 = -0.039$$

From the above calculation the Z1 and Z2 are not matching between 4.549 and 13.157 so effectiveness of knowledge sharing is insignificant and it can be concluded that the effectiveness of knowledge sharing does not exist.

C. The empirical relationship between knowledge sharing elements and effectiveness of knowledge sharing

The present research aimed at ascertaining the process of knowledge sharing in a global project development and its total effectiveness for the increase in the individual efficiency, organizational efficiency and productivity. The gaps in the literature clearly identified the various elements of knowledge sharing like sharing with internal team members, sharing with project developments with co-located team members and sharing with non team members besides these elements the literature also identified knowledge sharing on general views, specific requirements, process techniques, progress reports, total results and proper communication to onsite or offshore project team members. In this process of knowledge sharing is expected to have its relationship with job security, team reorganization, increasing competence advantage and improving customer focus. The research empirically proved knowledge sharing increases innovations and reduces inventory along with employee development, quality development and growth in the revenue. In this final stage it is indispensable to establish the relationship between knowledge sharing process and the effectiveness of knowledge sharing. Therefore the total average scores of the elements in the appendix Q3 to Q11 and Q14 to 15 are segmented, similarly the total average scores of twelve elements of knowledge sharing effectiveness are tested for the existence of correlation. The result of the test of the hypothesis is presented below.

TABLE-XIII CORRELATIONS FOR RELATIONSHIP BETWEEN KNOWLEDGE SHARING ELEMENTS AND EFFECTIVENESS OF KNOWLEDGE SHARING

		TKSE	TEKS
TKSE	Pearson Correlation	1	.125
	Sig. (2-tailed)		.030
	N	300	300
TEKS	Pearson Correlation	.125	1
	Sig. (2-tailed)	.030	
	N	300	300

Source: computed

From the above table it is found that the co-relation, coefficient $r=0.125$ and p value $=0.030$ are statistically significant at 5% level. This leads to the rejection of hypothesis at 5% level and concluded that there is a significant relationship between knowledge sharing process and effectiveness of knowledge sharing. The

knowledge sharing improves the customer focus, competitive advantage and innovative technologies. It has residual effectiveness over reduction of inventory, development of employee, cost reduction and revenue growth. The better decision making, intellectual property rights, faster response are also obtained in the organization in particular the knowledge sharing improved the perceptiveness in the quality and perfect delivery system without procrastination

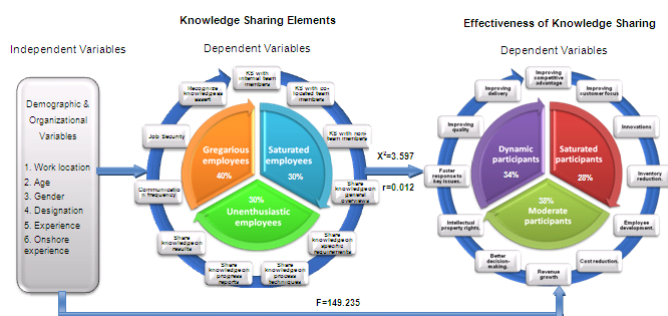


Figure 1 Knowledge Sharing Elements and Effectiveness of Knowledge Sharing Model

The factor analysis followed by cluster analysis is empirically applied on the block of knowledge sharing process and its effectiveness is classified into three different groups of employee's perception. The classification of knowledge sharing process and its effectiveness with respect to employee's responses are identified as Strong, Moderate and Weak Cluster. This shows that there exist three different groups of employees in IT Industry based on their perception on onshore and off shore knowledge sharing. The research further ascertained three prominent classifications in knowledge sharing needs namely career development Oriented Cluster, Sufficiently attained Cluster and Perfect Cluster respectively. The study further revealed the two prominent factors Innovative Competition and Organisational Dynamics in identifying the knowledge sharing. The knowledge sharing Practices in IT Industry are exactly classified into three groups Culminated Cluster, knowledge Oriented Cluster and Learning Cluster. The employee's perception again revealed the existence of three major factors Transformational Practices, Employee Up gradation and Policy Enforcement.

The study mainly focused on the knowledge sharing elements like Objectives, Needs and Practices. The Karl Pearson's Co-efficient of Correlation established a significant relationship among the various elements of knowledge sharing. In particular, the knowledge sharing is materialised with the help of onshore and offshore sub systems. The study highlighted on team approach and Development, Performance Assessment System and Career Growth Opportunities. An empirical relationship by Stepwise Discriminant Analysis is established for clusters of knowledge sharing effectiveness. An ingenious exploitation of Karl Pearson's Co-efficient of Correlation showed a parametric relationship between customer focus, competitive advantage with Career Growth of the

employees.

10. SUMMARY OF FINDINGS, SUGGESTIONS AND CONCLUSIONS

The main aim of the thesis emerged as an exploration of the managing global software projects through knowledge sharing process. It was soon realised that there are several knowledge sharing elements and its effectiveness influencing managing global software projects. Knowledge sharing processes have been studied in the literature for their impact on managing global software projects. However, no published work to examine on managing global software projects through knowledge sharing process.

The decision to focus on the key resources leaving the organization and the knowledge leaves along with the employee which affect the delivery of software development reflected an observation evident from the recent literature.

It is often said that it is essential to create a "knowledge sharing culture" as part of a knowledge management initiative. An isolated knowledge management program looked after by a privileged few is a paradox in itself and will not survive for long. Only effective collaboration and communication which spans across the whole company structure will give knowledge management the boost it really needs. In order to enrich a company's current culture the change must start at the individual. Every employee has a sphere of influence along with their own individual knowledge, and this is where he believes a knowledge sharing culture can begin.

A. Findings pertaining to objective 1

It is found that the current status of knowledge sharing process in IT companies is in introduction and nascent stage (26%) where as 24% of the employee perception is that the current status of knowledge sharing process is in growth stage. This clearly shows the importance of knowledge sharing process and IT companies is towards establishing the knowledge sharing process.

The IT companies employees identified lack of information is the key problems of globally-distributed development teams. 17% of the respondents said that loss of crucial knowledge due to key employee leaving the organization is the problem of globally distributed team so it is critical to implement mechanism to retain the knowledge of employees so that when employee leave the organization the knowledge retained within organization. Poor sharing of knowledge in the organization is another key problem of globally-distributed development teams (18%).

The perception of IT companies employees on knowledge sharing thinking is that it is strategic part of business (25%). 22% of the respondents are never heard about knowledge sharing, 14% of the respondents thing something they are already doing but not under the same name, 19% of the respondents feels that it is just a management fad. 20% of

the respondents things that something that could be beneficial for the organization.

Storing knowledge is another key factor in global software project organization. 31% of the respondents said that knowledge storage is quite important relevant and latest. 31% of the respondents feels that knowledge storage is quite important but not updated regularly and 38% of the respondents said that knowledge storage is just trivial, a part of formalities and of no use.

It is found that 27% of IT company's employees obtained relevant knowledge within few days and 25% of the responded derived knowledge within few minutes. Percentage analysis further revealed 23% obtained the required knowledge within few hours.

The survey results ascertain that the perception of IT companies employee on new knowledge creation is the job of internal quality department (29%) where as 24% of the IT companies employee said that it is everyone's job and everybody contributes to it, 23% of the respondents said that top management takes active interest in it and supports it continuously and 24% of the respondents said that it is part of our organizational philosophy and culture.

The research revealed the knowledge sharing strategy of IT companies where as 24% of the respondents said that knowledge sharing is a business strategy, 18% of the respondents said that they use transfer of knowledge and best practices as the knowledge sharing strategy, 20% of the respondents said that knowledge sharing strategy is customer focused knowledge, 19% of the respondents said that knowledge sharing strategy is personal responsibility for knowledge and 20% of the respondents said knowledge sharing strategy is innovation and knowledge creation.

The survey result also ascertained the approach of senior manager towards knowledge sharing implementation, 25% of the respondents said that senior management see knowledge sharing as very important and provides full support, 7% of the respondents said that senior management see it as very important but hardly supports it, 26% of the respondents said that senior management sees it as a waste and hardly bothers and 22% of the respondents said that senior management was very supportive in the beginning but now lost interest.

One of the major issues of investigation has been the impact of cultural background on the information sought in managing global software projects on knowledge sharing. In general 27% of the respondents think that knowledge management is the task of a few designated ones and there is no need for knowledge sharing. The biggest challenge to developing a global delivery system is getting all team members to work efficiently and effectively together. Sharing knowledge and expertise is crucial in any team, and in a team where members work in different countries and time zones and speak different languages. With respect

to biggest cultural barrier in knowledge management 18% of the respondents are at the opinion that functional silos is the biggest cultural barrier in knowledge management, 14% of the respondents said lack of participation is the biggest cultural barrier in knowledge management, 15% of the participants said not willing to share knowledge is the biggest cultural barrier in knowledge management, 14% of the respondents said lack of trust is the biggest cultural barrier in knowledge management, 11% of the respondents said knowledge sharing is not a part of daily work, 14% of the respondents said lack training and 15% of the responders said lack of rewards/ recognition for knowledge sharing.

The another conclusion on the Communities of Practice and the survey result ascertain that 94% of the respondents said "Yes" to globally-distributed development teams actively create and support Communities of Practice*(CoP's)" in their organization which shows that Communities of Practice exists in IT companies and employee is actively participating to build knowledge sharing process.

Biggest hurdle in effective implementation of knowledge management is that changing people's behaviour from knowledge hoarding to knowledge sharing (17%). 16% of the respondents are at the opinion that Lack of understanding of KS and its benefits is the biggest hurdle in effective implementation of knowledge management, 11% of the respondents are at the opinion that determining what kind of knowledge to be managed & making it available is the biggest hurdle in effective implementation of knowledge management, 12% respondent Justifying the use of scarce resources for KM, 16% of the respondents are at the opinion that lack of top management commitment to KM is the biggest hurdle in effective implementation of knowledge management, 13% of the respondents are at the opinion that overcoming technological limitations is the biggest hurdle in effective implementation of knowledge management and 13% of the respondents are at the opinion that attracting & retaining talented people is the biggest hurdle in effective implementation of knowledge management.

B. Findings pertaining to objective 2

One of the major issues of investigation has been the opinion of respondents on knowledge sharing and job security in global project management cases the employees of IT companies strongly disagree with the personal evaluations and expressed a neutral opinion on internal team members and their knowledge sharing, collocated team members and their participant in knowledge sharing. They are rational in identifying the influence of non team members, project goals and problems as well as personal evaluations. Therefore it can be concluded that the employee of IT companies are not fully involved in the knowledge sharing process amid the globalised phenomenal.

The effectiveness of knowledge sharing on project

management is not influenced by one parameter that it is a compositional of various aspects of relationship among the employees during offshore and onshore interaction process. The present study predominantly concentrate twelve factors of effectiveness of knowledge sharing process namely improving competitive advantage, improving customer focus, innovations, Inventory reduction, employee development, cost reduction, revenue growth, better decision-making, intellectual property rights, faster response to key issues, improving quality and improving delivery. This ascertains the employees of IT companies strongly disagree with the personal evaluations and expressed a neutral opinion in improving competitive advantage, improving customer focus and innovations. The research also revival that the employees of IT companies maintain themselves equidistant for Inventory reduction, employee development. It is also ascertain the perception of employees over cost reduction, revenue growth, better decision-making is also neutral in the opinion. It is identified that the employees rational in their acquaintance intellectual property rights, faster response to key issues, improving quality and improving delivery. Therefore it can be concluded that the employee of IT companies expressed equal importance on the 12 variables in achieving the best result in global software projects.

C. Findings pertaining to objective 3

The survey result found that onshore located employees strongly disagree with knowledge sharing corresponding to job security than the employees in the offshore location. This implies the onshore located employees have deep disagreement for knowledge sharing and it is relationship with job security. They feel the knowledge retaining is not at all affected their secured job. It is also found that other knowledge sharing process do not differ with respect to the opinion of onshore and offshore employees. In fact that they have the same opinion on knowledge sharing process in their organization

The employees of age group from 25 to 35 years, between 35 to 45 years and between 45 to 55 years are on the same opinion on knowledge sharing process. Therefore it can be conclude that the age group is not impacting the knowledge sharing process with in IT companies.

The gender male and female employees of IT companies are at the same opinion on knowledge sharing process. Therefore it can be concluded that the gender is not impacting the knowledge sharing process.

It is found that project manager, team lead, senior software engineer and software engineer of IT companies are on the same opinion on knowledge sharing process. Therefore it can be concluded that the different designation is not impacting the knowledge sharing process.

The survey result also ascertain that The IT companies employee work experience between 1 to 5 years, 6 to 10 years, 11 to 15 years and 16 to 20 years are on the same opinion on knowledge sharing process. Therefore it can be

concluded that the work experience is not impacting the knowledge sharing process.

The onshore work experience are grouped in to four category, less than 3 months, 3 to 6 months, above 6 months and no onshore experience. The survey result shows that the employees of IT companies are on the same opinion on knowledge sharing process. Therefore it can be concluded that the onshore work experience is not impacting the knowledge sharing process.

It is found that offshore located employees strongly disagree with knowledge sharing corresponding to improving delivery than the employees in the onshore location. This implies the offshore located employees have deep disagreement for effectiveness of knowledge sharing and it is relationship with delivery. The employee of IT companies feels that improving delivery is not related with effective knowledge sharing in achieving the best result. It is also found that the other eleven variables of effectiveness of knowledge sharing factors namely improving competitive advantage, improving customer focus, innovations and Inventory reduction, employee development, cost reduction, revenue growth, better decision-making, intellectual property rights, faster response to key issues and improving quality do not differ with respect to the opinion of onshore and offshore employees. In fact that they have the same opinion on the role of effectiveness of knowledge sharing process in their organization

The survey result found that age group between 23 to 30 years strongly disagree with effectiveness of knowledge sharing corresponding to better decision making than the employees in the age groups between 35 to 45 years and 45 to 50 year. This implies the age group between 23 to 30 years employees have deep disagreement for effectiveness of knowledge sharing and it is relationship with delivery. They feel improving delivery is not related with effectiveness of knowledge sharing in achieving the best result. It is also found that other eleven effectiveness of knowledge sharing factors namely improving competitive advantage, improving customer focus, innovations and Inventory reduction, employee development, cost reduction, revenue growth, intellectual property rights, faster response to key issues, improving quality and improving delivery do not differ with respect to the opinion of age groups between 23 to 30 years, between 36 to 45 years and between 46 to 50 years employees. In fact that they have the same opinion on the role of effectiveness of knowledge sharing process in their organization

It is found that male gender strongly disagree with effectiveness of knowledge sharing corresponding to revenue growth than the female gender this implies the male gender employees have deep disagreement for effectiveness of knowledge sharing and it is relationship with revenue growth. They feel revenue growth is not related with effectiveness of knowledge sharing in achieving the best result. It is also found that other eleven

variables of effectiveness of knowledge sharing factors namely improving competitive advantage, improving customer focus, innovations and Inventory reduction, employee development, cost reduction, better decision-making, intellectual property rights, faster response to key issues, improving quality and improving delivery do not differ with respect to the opinion of male and female employees. In fact that they have the same opinion on the role of effectiveness of knowledge sharing process in their organization

This research has demonstrated that experience groups between 1 to 5 years and 6 to 10 years strongly disagree with effectiveness of knowledge sharing corresponding to employee development than the employees experience groups in 11 to 15 years and 16 to 20 years. This implies the employee experience groups between 1 to 5 years and 6 to 10 years have deep disagreement for effectiveness of knowledge sharing and it is relationship with employee development. They feel improving delivery is not related with effective knowledge sharing in achieving the best result. It is also found that other eleven effectiveness of knowledge sharing factors namely improving competitive advantage, improving customer focus, innovations, Inventory reduction, cost reduction, revenue growth, better decision-making, intellectual property rights, faster response to key issues, improving quality and improving delivery do not differ with respect to the opinion of software engineer, senior software engineer, team lead and project manager designation employees. In fact that they have the same opinion on the role of effectiveness of knowledge sharing process in their organization

The onshore work experience of IT companies employees are grouped in to four category, less than 3 months, 3 to 6 months, above 6 months and no onshore experience, it is found that the employees of IT companies with all onshore work experience group are on the same opinion of effectiveness of knowledge sharing process.

D. Findings pertaining to objective 4

The survey result classified the employees of IT companies based on their response, first group consist of 120 employees (40%) with agreements for member responsibilities, preliminary findings, unexpected outcomes, or clear recommendations. Therefore this group of employees is known as gregarious employees.

The second group is a composition of 88 employees (30%) of with agreement for knowledge sharing with internal team members, knowledge sharing with non team members, sharing knowledge on progress reports such as status updates, resource problems or personnel evaluations, communication with your Onsite/Offshore project team members and recognizes knowledge as a part of their asset base. Therefore this group is known as saturated employees.

The third group is neutral in their opinion on knowledge sharing and it also comprises 30% of their employees

therefore this heterogeneous group of employees is known as unenthusiastic employees.

The research question on how many heterogeneous groups employees with different perception on effectiveness of knowledge sharing in global project management context. The result found that the first cluster consist of 101 employees (34%) with agreements for improving competitive advantage, employee development, improving customer focus, faster response to key issues, better decision-making, improving delivery and intellectual property rights. Therefore this group of employees is known as dynamic participants.

The second group is a composition of 84 employees (28%) with agreement for revenue growth, innovations, cost reduction and faster response to key issues. Therefore this group is known as saturated participants.

The third group is neutral in their opinion on effectiveness of knowledge sharing and it also comprises 38% of the employees, therefore this heterogeneous group of employees is known as moderators.

E. Findings pertaining to objective 5

This research has demonstrated that 36% employees working on single project at offshore location are highly gregarious. There is no entry of onshore working more than one project are saturated employees. This implies the work location is not affecting the knowledge sharing process. In fact it is not associated with different location where the employees are duty bound to share their knowledge. It is also found that 35% participants working on single project at offshore location are moderate participants. There is no entry of onshore working more than one project are saturated participants. This implies that the work location is not affecting the effectiveness of knowledge sharing.

It is found that 36% employees working reporting to one project manager are highly gregarious. This ascertains the association between knowledge sharing process and no of reporting manager. It is also found that 34% participants reporting with one project manager are moderate participants. There is no entry for employees who's reporting manager three, four and five are gregarious participants, saturated and moderate participants. This implies number of reporting manager is not affecting the effectiveness of knowledge sharing.

The research found that 11% employees are at the opinion that currently knowledge sharing does not exists are highly gregarious. 7% employees are at the opinion that current knowledge sharing is in growth stage are saturated employees. It is also found that 12% participants are at the opinion that knowledge sharing is at introduction stage are moderate participants. 7% participants are at the opinion that knowledge sharing is in growth stage are dynamic participants. This implies the current status of knowledge sharing is not affecting the effectiveness of knowledge

sharing.

The research demonstrated that 10% employees are at the opinion that problems of globally-distributed development teams is information overload are highly gregarious. 4% employees are at the opinion problems of globally-distributed development teams is information that overload are saturated employees. It is also found that 10% employees are at the opinion that problems of globally-distributed development team is lack of Information are moderate participants. 4% employees are at the opinion that problems of globally-distributed development teams is poor sharing of knowledge in the organization are saturated participants. This implies the problem of globally-distributed development teams is not affecting the effectiveness of knowledge sharing.

The survey found that the development team perception on knowledge sharing is a very important phenomenal to materialize the knowledge sharing process. It is also found that 10% employees perception of knowledge sharing is strategic part of their business are moderate participants. 3% employee's perception of knowledge sharing is something they are already doing it but not under the same name are saturated participants. This implies perception of knowledge sharing is not affecting the effectiveness of knowledge sharing.

It is found that 14% employees feels storing knowledge is quite important but not updated regularly are highly gregarious. 8% of employees feels storing knowledge is quite important but not updated regularly are saturated employees. This implies that stored knowledge is not affecting the knowledge sharing process. It is also found that 14% participants feels storing knowledge is just trivial, a part of formalities and of no use are moderate participants. 7% of participants feels storing knowledge is its quite important, relevant and latest are saturated participants. This implies that stored knowledge is not affecting the effectiveness of knowledge sharing.

It is found that 11% of employee feels it takes few minutes to get the relevant knowledge are highly gregarious. 7% of employee feels it takes few minutes to get the relevant knowledge are saturated employees. This implies time taken to get the relevant is not affecting the knowledge sharing process. It is also found that 11% of employee feels it takes few minutes to get the relevant knowledge are moderate participants. 4% of employee feels it takes few hours to get the relevant knowledge are saturated participants. This implies time taken to get the relevant knowledge is not affecting the effectiveness of knowledge sharing.

The research result on the association between knowledge sharing process and knowledge creation, It is found that 13% of employee view it as everyone's job and everybody contributes to it are highly gregarious and 4% of them are saturated employees. This implies knowledge creation is not affecting the knowledge sharing process. It is

also found that 14% of employees are at the opinion that it's the job of DFG and TQM department are moderate participants. 6% of employee's view it as everyone's job and everybody contributes to it are saturated participants. This implies knowledge creation is not affecting the effectiveness of knowledge sharing.

It is found that 12% of employee view knowledge sharing as business strategy are highly gregarious and 4% of employee views that personal responsibility for knowledge as KS strategy are saturated employees. This implies knowledge sharing strategy is not affecting the knowledge sharing process also the development team perception on knowledge sharing strategy is a very important phenomenal to materialize the effectiveness of knowledge sharing.

This research has demonstrated that 12% of gregarious employee responded approach of senior manager was very supportive in the beginning but now lost interest and 4% of saturated employees responded approach of senior management sees it as a waste and hardly worry. This implies perception on approach of senior management is not affecting the knowledge sharing process. It is also found that 13% of the employees responded that approach of senior management is very important are moderate participants and 6% of employees responded senior management was very supportive in the beginning but now lost interest are saturated participants. This implies perception on approach of senior management is not affecting the effectiveness of knowledge sharing.

It is found that 11% of employees think knowledge management is each and everybody's job, everybody has the best of knowledge and also the prevailing notion is that the knowledge management is the task of a few designated ones and there is no need for knowledge sharing are highly gregarious. 6% of employees have an open, encouraging and supportive culture are saturated employees. This implies development team's culture not affecting the knowledge sharing process. It is also found that 11% of participants think knowledge management is each and everybody's job and so everybody has the best of knowledge and also the prevailing notion is that the knowledge management is the task of a few designated ones and there is no need for knowledge sharing are highly dynamic. 6% of saturated participants think their basic values & purpose emphasise on sharing of knowledge. This implies development team's culture not affecting the effectiveness of knowledge sharing.

It is found that 38% of employees actively create communities of practice are highly gregarious. 2% of employees do not actively create communities of practice are unenthusiastic employees. This implies communities of practice not affecting the knowledge sharing process. It is also found that 36% of participants actively create communities of practice are moderate participants. 1% of participants do not create communities of practice are dynamic participants. This implies communities of practice are not affecting the effectiveness of knowledge sharing.

Association between knowledge sharing process and cultural barrier ascertain that 8% of employee's feels cultural barrier functional silos are highly gregarious. 1% of employees feel cultural barrier of knowledge sharing is not a part of daily work are saturated employees. This implies cultural barrier not affecting the knowledge sharing process. It is also found that 7% of moderate participant's responded lack of participation is the main reason for cultural barrier. 2% of saturated participants feel that knowledge sharing is not a part of daily work. This implies cultural barrier not affecting the effectiveness of knowledge sharing.

It is found that 8% of employees perception is that lack of top management commitment to knowledge management are highly gregarious. 2% of employee's perception is that changing people's behaviour from knowledge hoarding to knowledge sharing are saturated employees. This implies current hurdles not affecting the knowledge sharing process. It is also found that 8% of employee's perception is that biggest hurdle in effective implementation of KS is lack of understanding of KS and its benefits are moderate participants. 3% of saturated employees perception is that biggest hurdle in effective implementation of KS is determining what kind of knowledge to be managed & making it available. This implies current hurdle not affecting the effectiveness of knowledge sharing.

F. Findings pertaining to objective 6

Cluster justification of knowledge sharing elements and effectiveness of knowledge sharing proved that a poor knowledge sharing process exists in the perception of employees and effectiveness of knowledge sharing does not exist.

G. Recommendations

One of the objectives of this thesis was to discover the key success factors on managing global software projects through knowledge sharing for IT companies. From the findings discussed above it is possible to make some recommendation.

1. Implement mechanism to retain the knowledge of employees so that when key employee leave the organization the knowledge retained within organization

2. Create awareness on knowledge sharing and its benefits for both onshore and offshore employees

3. The age group between 23 to 30 years employees have deep disagreement for effectiveness of knowledge sharing and it is relationship with delivery. It is recommended to create more awareness on relationship between knowledge sharing and effectiveness delivery for these age group

4. Create more awareness among male gender on effectiveness of knowledge sharing and it is relationship with revenue growth

5. The employee experience groups between 1 to 5 years and 6 to 10 years have deep disagreement for effectiveness of knowledge sharing and it is relationship with employee development. It is recommended to create more awareness program for these employee groups.

6. The work location is not affecting the knowledge sharing process, it is recommended to implement common knowledge sharing practice for both onshore and offshore to minimize the cost spent on creating knowledge sharing awareness and training program.

7. The survey found that storing knowledge is quite important but not updated regularly, it is recommended to implement procedure and process to have regular knowledge update and also motivating and rewarding the knowledge sharing.

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