CONCLUSION AND SUGGESTIONS

6.1 Conclusions:

The conclusions drawn on the basis of the present study are furnished in the following paragraphs.

The study found that, from the sample 50 organizations about 4/5\textsuperscript{th} of the companies selected for the study have standing of more than 5 years and 3/4\textsuperscript{th} of them are having a workforce of more than 75 employees on their rolls.

More than 2/5\textsuperscript{th} of the companies are involved in developing only application software whereas remaining companies are engaged in development of web based application or combination of application s/w, web based application, mobile software, GPS software, ERP/SAP. Nearly half of the companies selected have developed upto20 software whereas 1/3\textsuperscript{rd} of the companies selected have developed more than 70 software. More than 3/4\textsuperscript{th} of the companies selected have an international market area and equal number of companies have their own brand software. Majority of companies are going for quality management system certification such as ISO and CMMi. It is found that, more than 3/4\textsuperscript{th} of the companies are ISO certified.

More than half of the organizations give training to their employees on yearly basis whereas remaining follows any other pattern and more than 2/5\textsuperscript{th} of the respondents believe in self learning for upgradation of their knowledge or adapting the changing technology, whereas 1/3\textsuperscript{rd} do so by attending workshops arranged by their organizations.

Majority of the companies take efforts to share knowledge of experienced staff with the inexperienced ones whenever a new project is assigned whereas 20\% of the organization do so on monthly basis. The study also found that more than half of the companies have a good knowledge sharing environment, and a minority i.e 1/4\textsuperscript{th} rated it as excellent. The remaining companies rated the same as fair.

In majority of the companies the knowledge management systems are at growth and established stage whereas remaining companies have knowledge management system at evolving stage. Nearly 1/3\textsuperscript{rd} of the organizations have established knowledge management system to improve their competitive advantage whereas another 1/3\textsuperscript{rd} companies have done so to help integrate knowledge within firm.
Almost all i.e., 90%, confirmed that companies recognize knowledge as their asset base and agree that knowledge management concept is useful in software development process.

More than half of the companies are working on .NET platform to develop software and also have 1 to 10 number of programmers working in a team whereas above 1/5th companies have 20 to 30 programmers in a team.

Nearly 75% of the organizations selected, frequently get repeated requisitions of same software which they had already developed earlier and almost all companies reuse the knowledge of previous project into the new ones. The degree of reuse is different and it ranges from 20% to 60%. About 1/3rd of the companies reuse 60% of the previous knowledge into new project and another 1/3rd repeat 40% of the previous knowledge, 1/5th of companies reuse less than 20% knowledge.

Almost all the respondents believes that software development process is suitable for application of previous knowledge. Majority of the companies have applied knowledge management in almost all the projects whereas, 1/10th of companies have done so rarely. More than 3/4th of the respondents agree that software engineering has a wider scope of knowledge management. Nearly 1/3rd of the respondent believes that knowledge management is most beneficial in analysis phase of software development

Nearly 75% of the organization reuse the modules, coding or designs of previous software into the latest version and almost all respondents agree that knowledge management helps in sharing best practices.

The majority (more than 75%) respondents agree that knowledge management helps in staff retention and collaboration and majority of the respondents agree that knowledge management increases the learning/adaption/innovation capability of employees and the organizations make necessary knowledge available on their knowledge portal.

Almost all respondents agree that knowledge management helps in defining software development process and improving existing process and believes that knowledge management application is important in software development life cycle.
The cross factor analysis have revealed that from the selected companies, Pune and Nagpur region are having maximum companies with KM at Growth and Establishing stage. It is discovered from the cross factor analysis that more than 90% of the companies have their existence from more than 5 years and amongst them majority companies have knowledge management at growth and establishing stage whereas, more than 60% companies have employee size of more than 75 on their rolls.

It is revealed from the study that, majority companies have developed more than 70 software and these companies have KM at growth and establishing stage whereas the companies who have developed 1 to 20 software have KM at evolving stage. This indicates that, the companies having developed more software have established systems of knowledge management.

The analysis reveals the pattern that maximum companies having KM at growth and establishing stage belongs to international market area. And maximum companies where KM is at evolving stage also belongs to the category of international stage. The companies who are operating at national or regional level have amongst them the majority in percentage terms are the companies having KM at evolving stage.

It revealed that, the majority of companies having the brand software have KM at growth and establishing stage whereas the companies who do not have brand software have KM at evolving stage. It also means companies who have established KM systems are developing brand software. Maximum companies who have ISO certification are having KM at Growth and Establishing stage. This is probably due to implementation of quality management system in their organizations.

It is discovered that, the majority companies where KM is at Growth Stage opined that the major problem with respect to knowledge is the loss of knowledge due to employee leaving the organization.

The cross factor analysis of status of KM with methods used by the companies to upgrade their employee’s knowledge, throws light on a pattern that the maximum companies where KM is at Growth and establishing stage prefer arranging workshops for upgrading their employees.
The pattern revealed from the cross factor analysis of status of KM and time duration taken to get relevant data shows that highest number of respondents who opined that it takes only few minutes to get the relevant data, have KM at Growth and establishing stage in their respective companies. This may be perhaps due to better KM implementation as the KM includes organization and dissemination of information and knowledge. The highest number of companies who have good and excellent knowledge sharing culture have KM at their growth and establishing stage whereas the respondents who have KM at evolving stage have a Fair KM culture. This supports the basic premise that KM culture helps organization to have implementation of knowledge sharing culture. The same has been endorsed by the Chi-Square analysis.

The present study found that, irrespective of the status of KM, majority companies consider knowledge as their asset. This endorsed the null hypothesis that, knowledge is considered as an asset. The pattern shows that the companies who have KM at growth and establishing stage have expressed that KMS have been established to improve the competitive advantage of the firm and to integrate knowledge in the organization.

The cross factor analysis of status of KM with KM is useful in software development process presents that, the maximum respondents who strongly agree that KM is useful in software development process have KM at its growth and establishing stage on the contrary the respondent who opted in majority for Agree category have KM status at evolving stage.

The facts revealed from the cross factor analysis of Status of KM with SDLC model used by the companies shows that majority of companies hailing from growth and establishing stage of KM category prefer Agile model and consider it as most suitable for KM process. The patterns emerged shows that maximum respondents who answered that there are 1 to 10 and more than 20 programmers in a team have KM at growth and establishing stage.

It is found from the study that, irrespective of status of KM the majority companies receive repeated requisition of software development and maximum companies irrespective of their status of KM, reuse the previous knowledge for new project.

The fact emerged from the present study that, majority companies irrespective of their status of KM believes that software development process is suitable for reuse of previous
knowledge. The trend emphasize that majority organizations whether having KM at growth or evolving stage get repeated requisitions. This indicates that the use of KM is significant in s/w development for bringing out the latest version.

The study discovered a pattern that the maximum companies having KM at growth and established stage make 60% reusability of the previous knowledge whereas the organizations who make least reusability of knowledge have KM at evolving stage.

The pattern emerged from the cross factor shows that maximum respondents who have applied KM in almost all projects have KM at growth and establishing stage. This indicates that those organizations where KM is in growth stage are more matured and use KM in all the s/w projects they manage. Whereas, maximum respondents hailing from evolving stage of KM have applied KM practices either in all projects or in few projects.

A trend is found that the highest number of respondents who believe that KM results in sharing best practices have KM at its growth and establishing stage in their companies. Those who opined their view as neutral belonged to the category of evolving stage of KM and that majority of organizations who believe that KM helps in better staff retention/attraction/collaboration have KM at growth and establishing stage. The organizations endorsing the view that learning and innovation is the outcome of KM have KM implemented at growth stage. The pattern discovered from the cross factor analysis of status of KM with knowledge available on K-Portal shows that majority companies who have KM at growth and establishing stage makes necessary knowledge available on their knowledge portal.

The analysis brings to light the fact that the majority companies who have KM at growth and establishing stage believe that KM helps in defining and improving software process and on the contrary majority respondents who have KM at evolving stage do not favour the given statement.

The pattern discovered from the study show that, the majority companies having KM at growth and establishing stage believe that KM is important in SDLC process whereas, the companies who have KM at growth and establishing stage opined in negation for the given statement.

The study revealed a trend that majority companies from every city consider Knowledge as their asset and, companies irrespective of its establishment period i.e from a newly
established company to companies having their existence from more than 5 years all of them consider knowledge as their asset base. Irrespective of the size of organization with regard to employee almost all show a similar trend of considering KM as asset base for the organization. All these factors shows their inclination towards knowledge management and paving way for Knowledge Management system.

The present study found that, majority of the companies who consider knowledge as their asset believes that Agile model of software development is more suitable for application of knowledge management principles.

The majority of companies, who consider knowledge as asset, prefer attending workshops or self-learning for upgrading their knowledge so as to adapt the change in technology. Majority companies give yearly training to their employees so that they enhance their knowledge. These companies arrange sessions where inexperienced staff share knowledge with experiences staff. All these factors indicates that the companies who considers knowledge as an important asset in majority provides an environment to promote self-learning, organizes workshops and provide expertise to upgrade the knowledge of their employees.

The pattern discovered suggests that, despite different challenges in sharing knowledge the majority of the organizations consider knowledge as their valuable asset. Maximum of the companies who considers knowledge as asset have KM at their Growth and establishing stage, provides good knowledge sharing culture and their employees need only few minutes to get relevant information. Perhaps, this is due to proper management of knowledge.

It is found that knowledge is considered as asset and it is useful in software development process. The analysis also suggests that, majority of the companies reuse their previous knowledge for software development and in general repeat or reuse 40% to 60% of the previous knowledge in their projects. Almost all of them consider knowledge as a valuable asset of the organization.

From the cross factor analysis of knowledge considered as asset with opinion about s/w development process is suitable for application of KM it is found that, majority companies who believe that s/w development process is suitable for application of KM considers knowledge as asset majority companies who repeat their previous knowledge in
the form of codes/modules into latest version of same kind of software considers knowledge as asset.

Most of the companies who consider knowledge as their asset base have applied knowledge management in majority of projects. Also these companies accept the fact that s/w engineering has wide areas of application for Knowledge Management principles.

The pattern evolved from the analysis that, nearly 90% of the companies who consider knowledge as asset believe that KM results in sharing best practices, helps in better staff retention/collaboration/attraction and, increases the learning/adaption/innovation capability of the employees.

The companies who consider knowledge as asset are in majority and also makes necessary knowledge available on the k-portal and believe that knowledge management helps in defining s/w process and improves existing ones. Majority companies who consider knowledge as asset confirms the importance of knowledge management in SDLC and their composition is around 90%.

The cross factor analysis of software development is suitable for application of previous knowledge with factors like cities, establishment period, number of employees revealed that, more than 90% companies are in affirmation that software development process is suitable for application of previous knowledge irrespective of their location, establishment period and size of organization in terms of number of employees.

The statistics of cross factor analysis of software development is suitable for application of previous knowledge with number of software developed by the company and market span of the company reveals that, the companies which developed less or many software, companies having market area of local, national or international, or companies having ISO certification or not, they all have endorsed same opinion that s/w development is suitable for application of previous knowledge.

It is found that majority companies have brand software and they also have shown agreement with the statement that s/w development process is suitable for application of previous knowledge.

It is found from the cross factor analysis of software development is suitable for application of previous knowledge with SDLC model used for the development of
software shows that, majority companies believe that Agile development model is suitable for KM and these companies also give their confirmation that s/w development is suitable for application of previous knowledge.

Cross factor analysis of software development is suitable for application of previous knowledge with opinion about software development is suitable for application of previous knowledge shows that, about 90% organizations endorsed the view that that software development is suitable for application of previous knowledge maintained by the firm.

The study also found that, software development is suitable for application of previous knowledge and efforts taken by the companies to share knowledge among experienced and inexperienced staff reveals the trend that, maximum companies arrange a session where experienced staff share knowledge with inexperienced staff whenever a new project is assigned and they also believe that s/w development is suitable for application of previous knowledge.

The study also found that, majority companies have good knowledge sharing culture and it takes only few minutes for the employees to get relevant information and also these companies endorsed the fact that s/w development is suitable for application of previous knowledge.

The majority of selected companies are having KM at its growth and establishing stage and they also are in agreement to the statement that s/w development is suitable for application of previous knowledge.

Almost all the selected companies believe that KM is useful in software development process and also majority of them are in agreement to the fact that, s/w development is suitable for application of previous knowledge.

Most of the companies who get repeated requisitions of same software reuse on an average 40 to 60 percentage of previous knowledge in new projects and also they repeat the previous modules/coding/designs into new s/w of same kind, thus endorsing that s/w development is suitable for application of previous knowledge.
It is discovered that a large number of companies consider software engineering has wide area of application of KM principles and believes that KM helps in defining new software process and improves existing ones; and they have implemented KM principles in almost all projects.

The pattern emerged shows that KM results in sharing best practices brings to light the fact that, they also confirmed that s/w development is suitable for application of previous knowledge.

The cross factor analysis of software development is suitable for application of previous knowledge with importance of KM in SDLC discovered the facts that, the majority of the companies who confirm the importance of KM in SDLC process also confirm that s/w development is suitable for application of previous knowledge.

Pattern evolved from the study shows that, software engineering has wide area of application of KM principles and cross factors like cities, establishment period of the companies and number of employees working show that, majority companies from every city believe that s/w engineering has wide area for application of KM principles; these companies are having standing of more than 5 years and having a talent pool of more than 75 employees. They all confirm the importance and role of knowledge management in the software development process.

The trend revealed from the cross factor analysis of software engineering has wide area of application of KM principles with number of software developed and market area of the companies shows that, majority companies irrespective of number of software they have developed or their market area such as local, national or international gave their consent in favor of s/w engineering has wide area for application of KM principles.

The pattern revealed from the cross factor analysis of software engineering has wide area of application of KM principles with SDLC model suitable for KM shows that majority companies believes that s/w development has wide area of application for KM principles, and agile development model is most suitable for KM and also they confirm that

It is clear from the cross factor analysis of software engineering has wide area of application of KM principles with efforts for sharing knowledge among experienced and inexperienced staff and knowledge sharing culture of the organization shows that,
majority companies arrange a session when experienced staff share knowledge with inexperienced staff and have a good knowledge sharing culture

The trend observed from the cross factor analysis of software engineering has wide area of application of KM principles with knowledge being considered as asset and status of KM at their companies is that, majority companies consider knowledge as their asset and have KM at their growth and establishing stage and also they gave their consent to the statement that s/w engineering has wide area of application for KM principles.

It is found from the study that all the companies are in agreement to the fact that KM practices are useful in software development and s/w development is suitable for application of previous knowledge and also believe that s/w engineering has wide area of application for KM application

The patterns emerged from the cross factor analysis reveals that, a large number of companies get repeated requisition of s/w development and reuse 40 to 60 percentage of previous knowledge in the form of design, coding or modules into the new projects and these companies as they believe that s/w engineering has wide area of application for KM application.

The study found that majority respondents believe that leadership and technology share an equal impact on knowledge management and KM results in sharing best practices and amongst these companies majority are in favor of the statement that s/w engineering has a wide area of application of KM principles.

Pattern emerged from the cross factor analysis of software engineering has wide area of application of KM principles with opinion about KM helps in better staff retention/attraction/collaboration show that, majority companies have endorsed the statement.

It is clear from the cross factor analysis that, maximum companies endorsed the importance of KM in software development and it helps in defining s/w process and improving existing ones. Thus it supports the statement of application of KM has wide scope in s/w development.
6.2 Suggestions:

The Suggestions based on the study are presented as below:

- The Software Development companies may go for establishing separate KM department in their respective companies as one of the functional department of the organization.
- The organizations should establish centralize storage of the best practices of Knowledge Management in software engineering so that, they can readily be made available as and when a new software development project is undertaken.
- Knowledge sharing helps in better functionality of the organization hence, employees should be motivated to share knowledge and in annual performance appraisal this should reflect a positive contribution from employees. It will boost the knowledge sharing culture throughout the organization.
- The organizations can maintain a data reusability matrix which will help in improving the software development process on a continuous basis.
- The organizations not using Agile Model may shift to Agile Model because majority of the companies who use this software engineering model showed better KM activities in their organization.
- The organizations from Tier-2 cities may opt for extensive use of KM Tools such as Collaborative Computing with Microsoft SharePoint, Web 2.0, Community Portals, Content Management Systems etc.
- The organizations who are going for tailor made software can exercise the option for branded software as the organizations with branded software have shown positive impact of KM on software development process.