

# An Empirical Study of Knowledge Sharing in Agile Organisations: An Indian Perspective

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**Abstract**—Knowledge is a core resource for agile organizations and sharing of knowledge is essential across any organization. Within teams, different members often have different deep knowledge and knowledge management is required in every software industry. This paper empirically investigates the knowledge sharing environment in the context of agile methodologies from software practitioners in India. This paper can serve as a reference to the agile users who tends to initiate knowledge sharing culture in the organisation. Organisations are divided into small, medium and large size based upon the total number of teams in the company using agile methodology. It is found that the communication-related issues are the major concern for effective knowledge sharing in the Indian software industry. Knowledge sharing through review meetings and the scrum of scrums are the most used practice among all respondents whereas informal meeting is the least accepted practice for knowledge transfer. We also employed cross table analysis to evaluate the association among practices adopted, issues faced for effective KS and company experience on agile software development.

**Keywords**— Agile software development, Knowledge management, Knowledge sharing, Organisational knowledge sharing

## I. INTRODUCTION

Software development is a knowledge-intensive activity [1]. Initially, agile methods have been developed for co-located and cross-functional teams and are supposed to be situated in the same room. All the members of the team are given joint responsibility for their project and build trust and communication in the team [2]. This teamwork provides support for the knowledge sharing among team members which is beneficial for the productivity of an organization. From a knowledge management perspective, the main focus of agile software development is to share tacit knowledge within team members, but offer limited support for knowledge sharing between the multiple teams.

Knowledge sharing is widely recognized to be a central component of successful knowledge management. It is fundamental to generate new ideas and developing new opportunities through the socialization and learning process of employees. Knowledge sharing enhances the overall performance of the organizations and it helps the individuals and groups to create new ideas, enhance the work process, and achieve creative solutions. Knowledge sharing is little complex in distributed teams than co-located team by using agile methods. Agile methods give emphasis on tacit knowledge shared i.e. informally using face-to-face communication whereas traditional knowledge management practices focused on the explicit knowledge share.

### A. Problem Definition

There has been a lot of research done in the knowledge management field, where many different theories have been revealed, but there is little research was done that investigates inter-team knowledge sharing in the agile methods. Agile methods and practices focused on intra-team knowledge sharing. However, they do not inform how to survive with that beyond the team levels. The main aim is to provide awareness about knowledge sharing environment in the context of agile to the practitioners in the country and also challenges faced in achieving effective Knowledge Sharing among team members.

### B. Purpose of the Study

This paper will describe the perceptions of practitioners in the country in terms of knowledge sharing environment, Agile introduction, methods adopted for effective Knowledge sharing and problems they are facing while knowledge sharing between multiple teams. As agile methods are widely adopted in large companies, there is a need for agile methods practitioners to address the lack of support for organizational learning in the processes. The purpose of this study is to investigate how knowledge is shared between agile teams in an organization using agile methods and corresponding knowledge practices. We have conducted a survey to understand the knowledge sharing

environment in the organizations and to understand the agile practices being followed in the software industry.

This research paper is structured into four sections. Section I contains the introduction of knowledge sharing in agile, Section II contains the literature review on this topic, Section III discusses the research methodology that was followed to conduct the research, Section IV contains an analysis of statistical data is under results and discussion and Section V the paper concludes providing some directions for future research.

## II. LITERATURE REVIEW

Knowledge has always been an asset in building capabilities for organizations and individual [3]. Nonaka & Takeuchi (1995) [4] distinguishes between explicit and tacit knowledge. Explicit Knowledge is the knowledge that can be easily documented, accessed and articulate. In contrast, tacit Knowledge is difficult to access or to express as it is embedded in the individual mind. Agile methods emphasize customer interaction in acquiring requirements and field knowledge. On the other hand, the traditional development approach focused on explicit knowledge sharing by using documents or repositories [2]. The traditional software development method had a strong focus on processes and a very distinct set of sequential stages consist of requirements gathering, designing and developing the software, testing the results, deploying the software, overall project management, and maintenance [5].

Agile methodology aimed at providing efficient and timely product iterations that give added value to customers through regular and progressive deliveries, incorporating both increased functionality and customer feedback. The focus has shifted to include less documentation but more attention to share knowledge from experience through verbal communication using agile practices [6].

Knowledge management, informally, can be defined as a set of strategies that capture, organize, and share both tacit and explicit knowledge of employees so that others in the organization may make use of and learn from the knowledge to be more effective and productive [7]. In the same way, [8] classified knowledge management into two broad strategies: the codification strategy and the personalization strategy. The codification strategy helps in systematises and stores organisational knowledge which can be reused by anyone. In contrast, the personalisation strategy encourage the flow of information through the organisation and communication between people. Traditional approaches support codification strategy whereas agile approaches move towards personalization strategy.

In agile methods, such as eXtreme Programming [9], Scrum [10] and Crystal [11], knowledge sharing is facilitated by several practices such as on-site customer, pair programming

and pair rotation, daily stand-up meetings, retrospectives, and cross-functional teams.

Agile is focused on tacit knowledge sharing. Karlsen et al., (2011) [12] performed a case study in an IT firm to investigate intra-project knowledge-transfer practices where the Scrum methodology is applied. Tacit knowledge sharing in an intra-team environment is promoted by agile methods by the adoption of various agile practices and customer involvement. However, the main focus on the product and delivery of value to the customer within less time, and the lack of a formal knowledge transfer practices can make knowledge sharing difficult. This may lead to repeat past mistakes, rather than learn from experiences. Therefore, this is a challenge to scale the knowledge on the group level to the organizational level effectively.

The Santos et al. (2015) [13] proposed a model that shows inter-team KS effectiveness depends on the organizational setting, stimuli and using purposeful practices. Organisational setting includes various parameters such as strategy, structure, culture, environment, top management and leadership support, communication flow and channels, integration among teams and projects, and deeper agile adoption. The practices include face-to-face conversations, pair programming between teams and projects, an informative workspace, collective meetings, rotation among teams and projects, technical presentations, and coding dojos are recommended. The stimuli include problems, common goals, sustainable pace, and incentives. Based on that conceptual model [14] performed a survey to measure the effectiveness of inter-team KS in agile organizations based on the factors, such as organizational strategy and communication flow and channels. They saw a significant relationship between the factors analysed and the organizations experience of using agile methods. Their findings confirm that simply using agile techniques are not enough for successful inter-team KS.

Deshpande and SD, Joshi (2009) [15] in their study explored agile communication challenges such as the balance between people- and process-oriented control and Lack of team cohesion. They provide suggestions to overcome these problems, which include people working in the same time zone, formal channels for informal communication, frequent visits by distributed partners and constant communication through tools.

## III. METHODOLOGY

To achieve the set objectives, a questionnaire was framed by taking care of the agile principles in Google forms. The questionnaire mainly consisted of close-ended, multiple choice type questions. Respondents were contacted by direct mailing and they were offered personal appointments to fill out a questionnaire. The population of the study was the Indian software engineering industries which are working

with an agile methodology. All kinds of software engineering organisations large, medium and small-sized have been included in the survey. Descriptive statistics tools (mean, frequency) and chi-square test are the tools which have been used to comprehend the collected data into a meaningful form. We performed descriptive statistics to analyse closed-ended questions. We also made a cross-table analysis by using chi-square test of independence to evaluate the association among practices adoption, issues faced for effective KS and company experience on agile software development.

#### A. Questionnaire Structure

A Questionnaire is a strategy or design for an empirical study to provide a quantitative description of some fraction of the population by collecting the data. The questionnaire had four sections. Background information, agile methodology, and practices used by respondents, Knowledge sharing environment, and challenges faced by respondents in effective knowledge sharing. Survey questions were as follows:

1. Agile methodology used by respondents
2. Agile practices used
3. Knowledge Sharing Environment (five-point likert scale)
4. How do you Share Knowledge in your teams? (multiple choice)
5. Knowledge Sharing Practices (multiple choice)
6. What motivates you to share knowledge? (multiple choice)
7. Challenges faced by Respondents in Agile Knowledge Sharing
8. Do you think the time zone difference is an issue for effective Knowledge sharing?
9. Analyzed associations between KS practices adopted according to experience on Agile
10. Analyzed associations between the Problems faced in KS according to experience on Agile

#### B. Respondents

The data has been fetched from total 54 respondents. The main positions of the 54 respondents were as follows: software developer 48%, Team member 17%, software tester 15%, and Scrum Master 7%. The rest (14%) are recorded as Project Manager, SAP consultant, and Business Analyst. All the respondents had different years of experience. 37% of respondents had 3 to 5 years of experience, 35% had 1 to 3 years of experience, 20% had 5 to 7 years of experience and 7% have 7 to 9 years of experience. Of the 54 respondents 46% were from a large organisation where a number of teams using agile methodology was more than 30, 28% of the respondents were from small size organizations where a number of teams range was 2 to 9 and 26% from the medium size organisations which led 10-30 number of teams.

## IV. RESULTS AND DISCUSSION

This section of the research paper will describe the results based on gathered information. The information collected from questionnaire responses were studied, analyzed and represented in table and chart form.

### Agile Methodology

Agile is a group of development methodologies. It is an umbrella term used for many methodologies which share common attributes. so multiple responses were possible to an answer about the agile methodology used. As shown in Fig. 1, Scrum was the most widely used agile method (94% of the respondents), followed by Kanban, XP-Scrum (Hybrid) and XP (Extreme Programming). DSDM, Lean and FDD are the least popular practices which are used by the organisation. Others (2%) percent of respondents are using other agile methodologies which are not mentioned in our list.

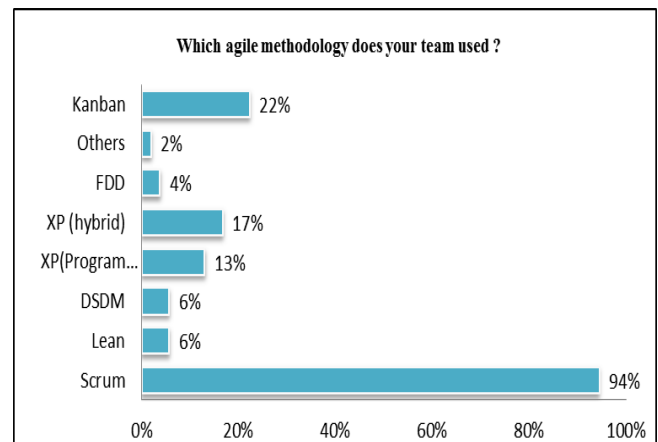


Figure 1: Proportion of different types of agile methodology used by respondents

### Agile Practices

According to the survey results of Fig. 2, the top five practices used by respondents are Daily Standup (78%), Short iterations/sprints (57%), Release Planning (57%), Iteration/sprint planning (56%) and Iteration/sprint reviews (44%). Whereas the Collective code ownership (37%), Continuous deployment (37%), Retrospectives (37%), Pair programming (24%) and Collective code ownership (9%) are the least used practices.

### Knowledge Sharing Environment

In this section, the main aim is to present the findings from the concepts that focussed on an understanding of the organizations' environment in knowledge sharing. 5 different concepts of the Knowledge Sharing Environment following a five scale method are tested in this question. These 5 concepts are as follows:

1. In our company, Employees communicate with each other through informal meetings

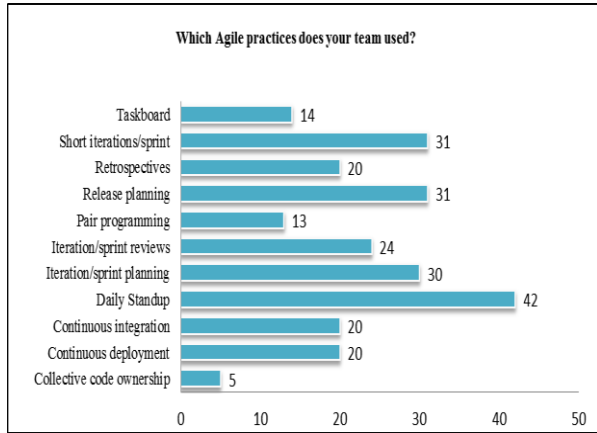


Figure 2: Proportion of different types of agile practices used by respondents

2. We regularly work with cross-functional and self-organizing teams and thus knowledge sharing within these teams is normal practice
3. Our company is good at transferring best practices including organizing and documenting the knowledge it already possesses
4. Our company actively encourages communication and teamwork in office space.

5. In our company, we help each other to learn new skills regardless of seniority.

According to Table 1, the third concept (Our company is good at transferring best practices including organizing and documenting the knowledge it already possess) recorded the highest percentage of agreement with more than 80%, while the first concept (in our company, Employees communicate with each other through informal meetings) recorded the highest percentage of disagreement with 24%. In addition, the lowest percentage of disagreement is recorded with the fifth concept (in our company, we help each other to learn new skills regardless of seniority). The findings show that the highest percentage of the participants who are not sure about the concept is recorded to the first concept (In our company, Employees communicate with each other through informal meetings) with 40.7%. While the lowest percentage of those who are not sure about the concept is recorded to the third concept (Our Company is good at transferring best practices including organizing and documenting the knowledge it already possess). The overall results suggest that the second, third, fourth and fifth concept recorded the highest percentage of agreement.

Table 1: Knowledge Sharing Environment

Concept	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	5.5%	18.5%	40.7%	29.6%	5.5%
2	3.7%	7.4%	14.8%	53.7%	20.3%
3	1.8%	9.2%	5.5%	62.9%	20.3%
4	3.7%	3.7%	12.9%	50%	29.6%
5	1.8%	1.8%	14.8%	50%	31.48%

**How do you Share Knowledge in your teams?**

Figure 3 is showing the most common techniques for knowledge sharing are in meetings (80% of the respondents), by email (74%) and presentation (56%). The teams are usually the basic social units of an organization’s knowledge creation and Scrum is the most widely used agile method in the companies which emphasizes the role of collaborative teams. The next most commonly used knowledge sharing techniques with teams are the phone or video link (30%) and

informally (26%). The least used technique is an electronic bulletin board (7%).

**Knowledge Sharing Practices**

Inter-team KS is achieved by the adoption of these practices for socializing knowledge. The results from Figure 4, shows that Review meetings (74%) and Scrum of Scrums (57%) are the most common using practices for the KS. 31% of the respondents indicated that they are using communities of practices. Rotation of people among projects (22% of the respondents) is used by the organizations to compose a new

team or to add a new member to an existing project. Coding dojos and Apprenticeship are the least using practices. With the Coding Dojos, different teams are learning about programming best practices, while Apprenticeship is used for pairing between seniors and juniors.

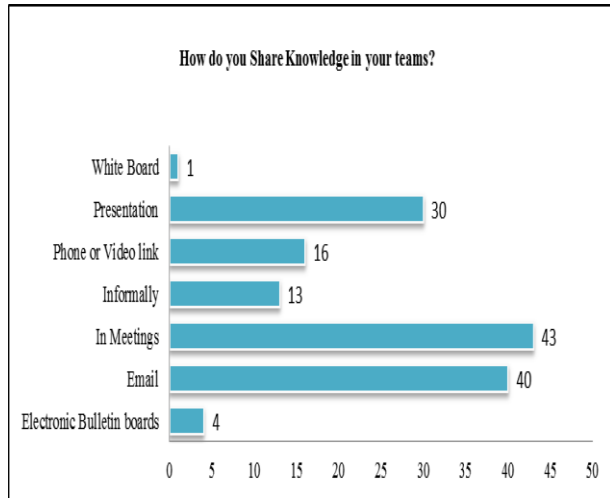


Figure 3: Knowledge Sharing Sources

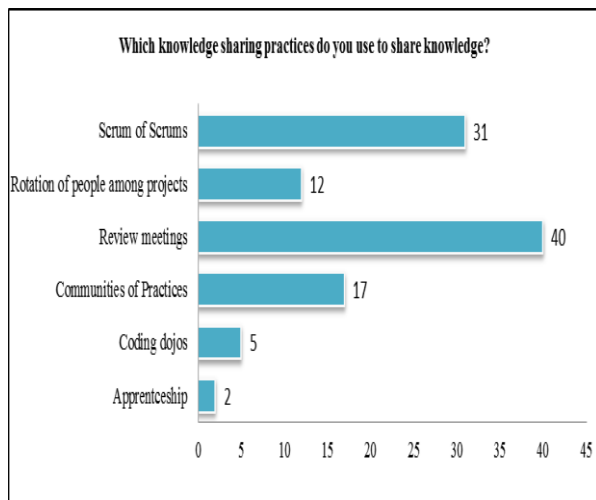


Figure 4: Knowledge Sharing Practices employed

**What motivates you to share knowledge?**

People need to be motivated to perform well, and with a high level of motivation, we expect a high level of performance and output. In the below Figure 5, we have intrinsic, extrinsic and both intrinsic and extrinsic types of motivation sources. The most common intrinsic motivation source used for KS is I have knowledge that I want to share (62 of the respondents), followed by enjoyment (40) and the formal position has told me to share (35). The most common extrinsic motivation source used for knowledge sharing is to strengthen ties with other people and least used is

organisation rewards for sharing knowledge. 46 of the respondents reported both intrinsic and extrinsic types of motivation source that is to full fill my responsibilities.



Figure 5: Motivation Sources

**Challenges faced by Respondents in Agile Knowledge Sharing**

According to Figure 6, the main issue faced by the respondents is communication-related issues within the agile projects followed by Team Perception (26%) and Team dynamics (18%). 11% of the respondents indicated that they have knowledge and skill related issues amongst team members. One of the respondents said that they do not have a lot of time to learn new skills from our senior

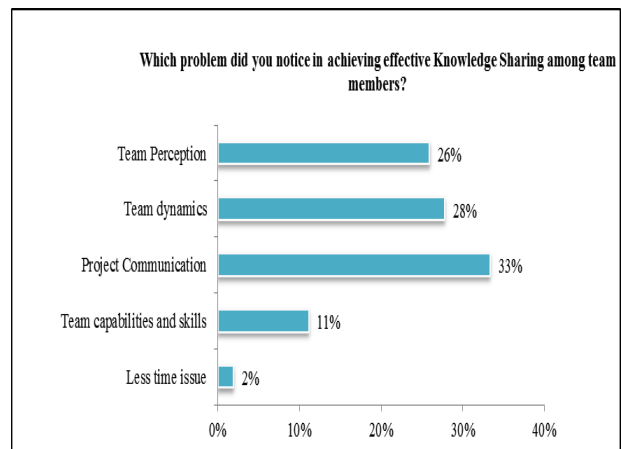


Figure 6: Proportion of different types of challenges faced by respondents

**Do you think the time-zone difference is an issue for effective knowledge sharing?**

In this question, we asked whether they believe that the time zone difference is an issue for effective Knowledge sharing. 35% participants of the survey agreed that the time zone difference is an issue for successful Knowledge sharing. However, 41% of respondents said that the time zone difference is not an issue for knowledge sharing in the different time zone (Figure 7).

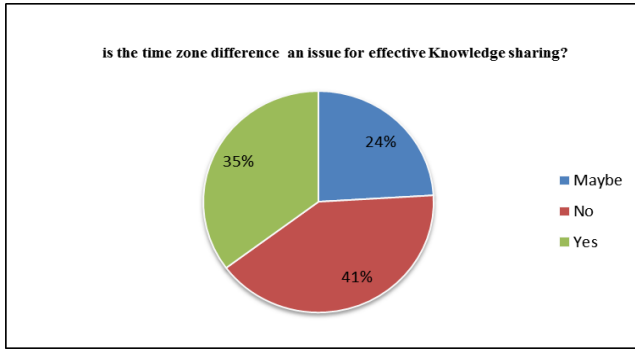


Figure 7: Frequency of time zone difference issue faced by respondents

hypothesis. Rather, we conclude that there is not enough evidence to suggest an association between KS practices adopted by respondents and experience. Another interpretation is that review meetings mostly adopted by the respondents in all subgroups. Additionally, we realize that Coding dojos and Apprenticeship tend not to be considered for adoption by all subgroups.

**Cross-table analysis of the Problems faced in KS according to experience**

Table 3 presents the Chi-Square value for the association between the barriers for KS and according to company experience. The results show that there is not a significant association as the p-value is greater than our chosen significance level. According to the sample responses, most participants in the study perceive barriers for Team Perception with 1 to 5 years of experience in agile methods. In the other practices, respondents report barriers mostly when they have between 3 to 5 years of experience.

**Cross-table analysis of the KS practices adopted according to experience**

Table 2 presents the Chi-Square value ( $\chi^2$ ) for the association between the level of adoption of the practices and according to experience in agile. Since the p-value is greater than our chosen significance level, we do not reject the null

Table 2: Cross-table analysis of the KS practices adopted by experience

Group	Sub Group	Scrum of Scrums		CoP		Rotation of People		Review Meetings		Coding dojos		Apprenticeship		Total	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
Year of experience	1 to 3	9	29	5	29.4	5	41.6	14	35.9	2	40	1	50	36	33.96
	3 to 5	11	35.4	6	35.2	4	33.3	16	41	3	60	0	0	40	37.73
	5 to 7	8	25.8	4	23.5	2	16.6	6	15.3	0	0	1	50	21	19.81
	7 to 9	3	9.6	2	11.7	1	8.3	3	7.6	0	0	0	0	9	8.49

Statistical Results: Chi-Sq.= 0.972, Degree of Freedom = 3; level of significance= 0.05; p-value = 7.815

Table 3: Cross-table analysis of the Problems faced in KS by experience

Group	Sub Group	Project Communication		Team capabilities & skills		Team dynamics		Team Perception		Others		Total	
		n	%	n	%	n	%	n	%	n	%	n	%
Year of experience	1 to 3	6	33.3	1	16.6	4	26.6	7	50	1	100	19	35.1
	3 to 5	7	38.8	2	33.3	5	33.3	6	42.8	0	0	20	37
	5 to 7	4	22.2	3	50	4	26.6	0	0	0	0	11	20.3
	7 to 9	1	5.5	0	0	2	13.3	1	7.1	0	0	4	7.4

Chi-Sq.= 0.864, Degree of Freedom = 3; Level of significance= 0.05; p- value= 7.815



## V. CONCLUSION AND FUTURE SCOPE

Our survey study contributes to the awareness of how knowledge is shared in agile organizations. The study is restricted to the Indian software industry and thus it cannot be concluded universally until more research has been conducted throughout the world. The findings will help to reduce the issues encountered when they are trying to introduce agile methodologies. This study adds evidence to the knowledge of the software development process; at the same time, it provides awareness and reference about agile knowledge sharing to the country. This research points out the need to extend the study to other countries or regions, and larger teams which could give new vision. Therefore, we strongly encourage researchers to contribute by conducting research in large organizations which adopted agile methods and have knowledge sharing culture. However, it is hoped that based on the findings from this study, Knowledge sharing in agile organizations will improve.

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