# UNIVERSITY OF GOTHENBURG

# An empirical study of the Decision-making process in Agile software development based on industries from China

*Bachelor of Science Thesis in the Programme Software Engineering & Management*

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## ABSTRACT

The efficiency of Agile software development is directly associated with the decision-making among Agile team members. This article aimed at improving the decision-making process in Agile software development. In order to answer the research questions, we designed a mixed method approach. We identified three categories of challenges and provided related solutions of decision-making process in Agile software development through immense amounts of literature review. We also collected data through a survey with forty-eight participant outcomes. In the light of the survey, the results presented five main decision-making challenges in Agile software development of China's context. Furthermore, we suggested a number of recommendations in several perspectives to improve the decision-making process of Agile development.

## Keywords

*Agile development; Agile in China; Decision-making*

## I INTRODUCTION

Over recent decades, Agile software development (ASD) methodologies have existed in the mainstream software developers. They accepted Scrum, Crystal, Extreme Programming and other methodologies [6]. ASD involves a radically new method of the decisions made in the face of software development, which requires more speedy and short-term decisions [29]. The decision-making process has crucial influence on the success of software projects.

Since the role of the manager as a decision-maker is critically reduced in ASD, a team developer's performance in decision-making process is becoming more important [16], and the manager is becoming a coordinator or facilitator [2] [21] [32]. The Agile team makes majority decisions, producing a shared decision-making condition on the basis of different experiences, personalities, and attitudes of team members [14] [15]. The manager and team members frequently confront a large number of tasks, these tasks

need flexible change and their expectations, require to make decision during daily meetings.

The Agile team members provide a sizable amount of information with diverse attributes that possibly have an influence on decision-making. McAvoy and Butler [27] have mentioned that Agile teams are facing challenges when they are trying to make decisions. For example, team members can be unwilling to commit to a decision, through a lack of participation and also, they can cause communication problems during projects [16]. These challenges can badly hamper the process of ASD and affect longer-term, strategic focus for decisions, as well as delaying work and reducing the enthusiasm and engagement of teams as reported by Moe [29].

There has been some literature describing the challenges of decision-making in Agile development. The decision-making culture of China attracts our attention. Therefore, this study will discuss the decision-making process in China as it integrates with Agile development. There are differences in the ways Chinese and Western managers make decisions in Agile development. Although China has indeed made important progress in Agile in recent years, the level of development remains low compared to other countries in terms of the decision-making process. The Chinese decision-making process is often classified into two categories: collectivistic culture and no decision-making [19]. The collectivistic culture of the Chinese leads to a consensus building decision-making approach which can be regarded as a safe decision. The no decision-making category means that in China, team members often regard the manager as the master, so every decision must be made by the boss; others just need to wait for instructions [38].

*Research objective*
The objective of this study is on understanding, investigating and identifying the problems of the decision-making process which exists in ASD of Chinese companies, and developing appropriate suggestions to support decision-

making in ASD with the approach of qualitative study. The challenges during this process are poorly understood in China [39]. This paper will attempt to provide possible solutions to overcome the existing challenges and improve the decision-making process through a Systematic Literature Review. Also, the study also provides insight into Chinese companies, when it comes to the decision-making process. We will analysis the challenges from the survey in the Chinese companies prior to providing useful recommendations. This leads to the following research questions:

> **RQ1:** *What are the challenges surrounding the decision-making process in Agile software development in China?*
> **RQ2:** *How can the decision-making process in Agile software development be improved in general?*

***Scope***
Both developers and customers have a big influence on decision-making in Agile teams. But our scope will be delimited to the developers and organizations which produce products, which means the customers will not be involved in our study. Participants are selected from the members in different roles in Agile teams. The research will also be limited within the IT field.

The remainder of the paper is organized as below: In section 2, we describe the related research on overall decision-making and the decision-making in ASD as well. In section 3, we present the methodologies that make use of our research. In section 4, we synthesize our findings from both systematic literature review and survey investigation. In section 5, we discuss the research results from diverse point of views. In section 6, we summarize recommendations. In section 7, we describe limitations and future research. In section 8, we make a conclusion.

## II Related Research
### Agile methodology
In software development work, the focus of the distribution is a clear definition of role, let individual abilities to adapt to the role, and the definition of the role is to ensure the implementation of the process, namely individuals as the form of personal resources are assigned to roles. Meanwhile, the resources can be replaced, and the role can not be

substituted. But these methods in traditional software development are completely overturned in Agile development way. Agile development tries to make software developers take advantage of their characteristics, gives full play to people's creativity [35].

The purpose of Agile development is to build a project team of full participation in software development. This includes not only developers but also include manager who sets up the software development process management, this is the good way to make the software development process acceptable [35]. Meanwhile the Agile R&D team members should have an independent technical decision-making power, because they know best which technology is needed [36]. Moreover, the Agile development pays special attention to the information exchange within the project team. This is important because failure can often be traced back to timely and accurate information be delivered to the people who should receive it.

### Understanding decision-making
Decision-making can be regarded as the performance of a task [4]. Decision-making is a prevalent behavior of people in political, economic, technology, and daily life. Decision-making is also management activities with the meaning of determining. In order to achieve specific goals, decisions have been made on the basis of objective possibility and a certain share of information and experience. Meanwhile, with the help of certain tools, techniques and methods should be used for the purpose of calculating and determining the optimal selection decision for future action. Therefore, decision-making is creative management techniques, including the discovery of the problems, identify goals, determine the evaluation criteria, program development, program the selection process, and program implementation.

In decision-making, there is a classic five-step approach [1]. However, it does not mean the team should follow it blindly in all situations. As can be seen:

1   Define the objective
2   Collect relevant information
3   Generate feasible options
4   Make the decision
5   Implement and evaluation

## Decision making bias

It is important to have correct decision without biases. In the decision-making process, there are a number of factors such as experience, time pressure and unusual situation could influence the individual into certain decision [37]. This is supported by McAvoy and Butler [27]. The name of Abilene Paradox [26] derives from a trip to Abilene by Professor Jerry Harvey. On a hot day in July, Harvey and his family were content to be sitting on the back porch of his father-in-law. His father-in-law made a suggested going to Abilene for a meal. Although Harvey considered it was a bad idea but he thought the others might be bored. None of the other family members rejected the suggestion either [26]. The story refers to many organizations, despite everyone's are reluctance, collective decision-making is contrary to the wishes of the individuals.

In Agile software development, ineffective decision-making occurs due to the desire to conform among team members [26]. Writers present the desire for cohesion in a group can give rise to ineffective decision-making, where agreement is of utmost significance, may be correct [11] [17] [20] [30].

There is now a general consensus that team members are in a position to make decisions that ignore their own preferences because of rules, tradition, or the suggestion of others [25], the term herd behavior has been used to describe by Banerjee [5] describes an experiment where this behavior is emphasized as taking the form of a sequence of decisions: for instance, every decision-makings review the previous decisions prior to making his/her own. Banerjee showed that individuals are overly influenced by the decision rules of others and fail to apply their own rules and information: this is described as herd behavior. These observations collectively demonstrate that the crucial influencers in a team decision do not have to be the experts or the leaders [26].

## Agile decision-making

The decision-making in Agile development empowers people with more decision powers which are not limited to a given role. Underlying in Agile development is the idea that to build a project team, everyone in the team should participate in software development, including the manager. This is the only way that the software development process will be acceptability. Agile development requires developers to make decisions independently in technical issues because they understand what technology is needed. Furthermore, Agile development pays special attention to the project team with the exchange of information. The ultimate outcomes are concerned with the groups' overall performance.

Not unexpectedly, it is important to understand how the theory of self-management works in the process. In Agile groups, the developers should both place special emphasis on managing the team and executing their tasks [18]. For example, the group managers have a share in leadership in decision-making, the skills and abilities are transferred to the group members. Hence the manager in such groups is supposed to be spread rather than centralized [31].

The product and project levels decisions are concerned with strategic, tactical and operational levels in Agile decision-making process [3]. These can be summarized as follows:

- Strategic decisions are mainly dealing with product and release plans.
- Tactical decisions relate the project management perspective, where the objective is to decide the best way to implement ASD strategic decisions.
- Operational decisions impact on the implementation of product features and the process of guaranteeing that particular tasks are executed effectively.

## Agile in China

Agile was brought to China ten years ago. Some Chinese IT companies have so far only scratched the surface of this field. Other companies who have entirely accepted the Agile would be thwarted [33]. However, it is safe to say, in fact, that Agile concepts and practice has been widely disseminated and adopted [12]. Flexibility became a common pursuit. More and more cross-functional teams were formed so that Agile management and technical practices can be finally implemented to promote industrial progress.

Since the whole industry began to embrace Agile, the controversy surrounding ASD has slowly crescendoed. The majority of the controversy focused on the effective implementation and the value of promotion. If

the team lacked effective implementation, Agile will not bring value. If you can not see enough value, why they should vigorously promote the implementation? The current Agile theory of the various fragmentation and case sharing can no longer meet the needs of the mainstream population and the contradictions of implementation and value [12]. Therefore, these companies placed special emphasis on completing the program, both to help the effective implementation, and can effectively enhance the value.

In China, due to the fact that Scrum framework does not set the position of manager and lead position, there is often out of shape when the Scrum process is implemented. The manager and lead camouflage as the Scrum Master in a great number of instances, and then business as usual, while the Agile team does not really set Scrum master position [22]. This is because the team is very young, on the one hand, they do not dare to really implement the self-organization. on the other hand, they want a fashionable implementation of Scrum so they copy the form without understanding the substance. In fact, to manage employees is the most difficult thing, self-organizing is only one possible way of management in ASD [7], however, the management approach of self-organizing is unlikely to succeed in China. This is one of the reasons why the pure Scrum landing in China is difficult [38].

**Decision making in China**
The culture of decision-making in Chinese companies has been an area of intense investigation. Buchanan and O'Connell [10] have reported that there is a general consensus that cultural background has been identified as influential in decision-making process for internationalizing firm. As we know, Chinese culture is often known for its particularism and insistence, which promotes personal relationship [13]. In terms of collectivistic culture, the Chinese consensus building approach can lead to a "safe" decision - or worse, no decision.  As a result, Chinese managers tend to agree; tend to decentralized decision-making responsibility, not to take responsibility [19]. In addition, in several Chinese enterprises, the identification phase of decision making is characterized by employees' lack of involvement in the process and a poor information culture [19].

However, the scientific decision methods are not well known. As relative statistical data of Chinese enterprises is not affluently available, and as managers, preoccupied by their tasks, are less interested in decision science at the present [38].

## III Research Method
The focus of this study was to identify the decision-making process in Chinese companies and also find solutions to improve the process. In order to address the two research questions (RQ1 and RQ2) mentioned above, a qualitative approach was applied. The methodology (see Figure 1) used was a qualitative systematic literature review with a survey investigation.

- ✦ Literature review (RQ1,RQ2)
- ✦ Survey investigation (RQ1)
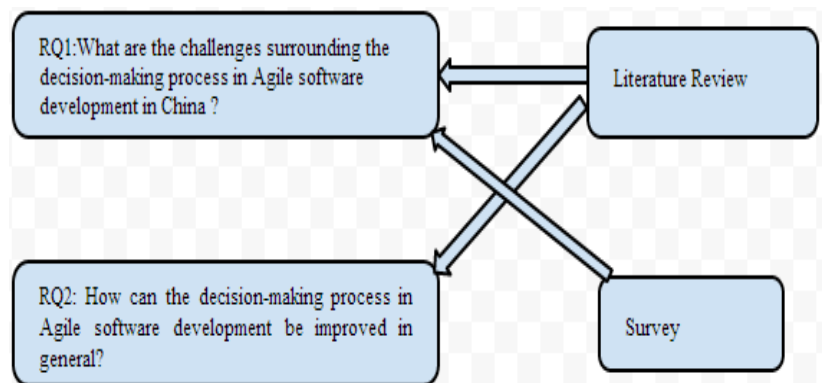


**Figure 1 Methodology**

We followed the following research process:
1. We conducted a literature review to gather related theoretical information about challenges surrounding the decision-making process in Agile software development and recommendations of improving Agile decision-making process (RQ1, RQ2).
2. Based on the literature results, we surveyed 10 Chinese IT companies using questionnaires (See Appendix A) to know the Agile challenges in Chinese companies (RQ1). A number of closed and open-ended questions were used to collect raw data.
3. We synthesized from literature review and survey results.

**System Review**
     1.    Data Collection
During our literature review, we used a Systematic Literature Review (SLR) process [23] because an SLR is a suitable means of identifying, evaluating, and interpreting all available research relevant to a particular research question [23]. An SLR provides

information about the effects of some phenomenon through a wider range of settings and empirical methods, although it requires more effort than the traditional reviews [23].

**Searching Strategies**
As stated by Kitchenham [23], it is necessary to generate a search strategy. We used scientific papers for the primary study resources. The studies could be either conceptual or concrete (survey, experiment, case study, diagram etc). The search was done automatically using the following search engines.

- IEEE Xplore
- SpringerLink
- ACM Digital Library
- Elsevier ScienceDirect

**Searching terms**
We used search strings (see Figure 2) to search for our primary studies.

- Studies that provide recommendations to improve decision-making process.
- Studies that relevant to Chinese decision-making process in the context of Agile software development.
- Studies that were issued between 2001- 2013. Because studies referred to Agile were more complete after the Agile Manifesto was published in 2001.
- Only papers written in English and available online were included.

**Study selection process**
The selection process in systematic literature review was guided by the following steps:
1. We searched databases for all the potentially primary studies related to the decision-making process in Agile software development and got all the primary studies.
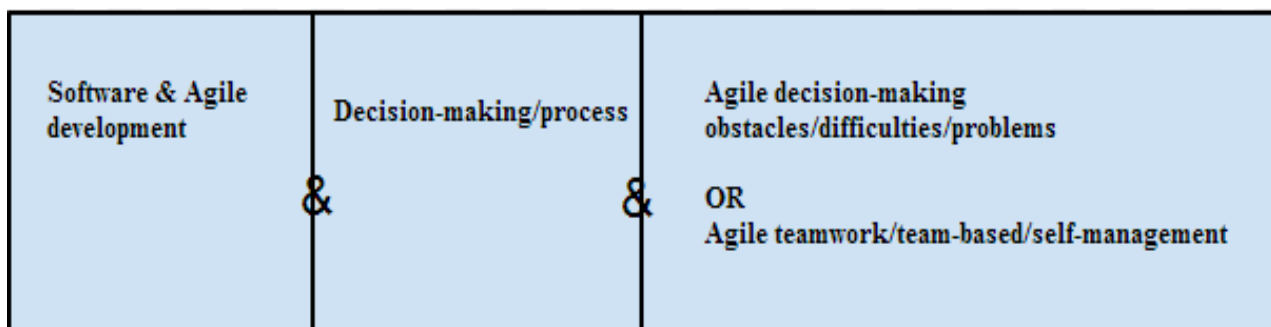2. We identified the primary study resources



| Software & Agile development | Decision-making/process | Agile decision-making obstacles/difficulties/problems |
| | & & | OR Agile teamwork/team-based/self-management |

**Figure 2: Search String**

**Study Selection Criteria**
After the above searching, we obtained quantified primary sources of information. An inclusion criterion was used to filter the papers we found. Inclusion criteria aimed to identify which papers could be used and included in the study and papers which did not conform to these criteria were excluded. Therefore, studies were selected according to the following inclusion criteria:

Inclusion Criteria:

- Studies that describe decision-making process in the context of Agile software development.
- Studies that describe challenges in decision-making process in the context of Agile software development.

and excluded resources not relevant to our topic according to our study selection criteria based on titles of papers.
3. We reviewed the abstract of papers and the double papers were removed.
4. We conducted discussions between investigators and also consulted with the Supervisor.
5. All unique studies were presented in the Table 1.

**Data extraction**
We extracted data from the papers using the following parameters:

- The research methods used.
- The context of each paper.
- The challenges or obstacles that researchers found.
- The solutions or recommendations that researchers provided.

7

**Table 1: Final selection of primary studies**

| Database | Primary Studies | Title Selection | Abstract Selection | Unique Hits |
|---|---|---|---|---|
| IEEE Xplore | 68 | 30 | 11 | 10 |
| SpringerLink | 121 | 11 | 2 | 2 |
| ACM Digital Library | 22 | 20 | 2 | 2 |
| Elsevier ScienceDirect | 40 | 32 | 7 | 3 |
| Total | 251 | 93 | 22 | 17 |

### 2. Data analysis

We used a thematic analysis [9] to analyze the collected data, which was guided by Braun and Clarke:

1. We went through all data from literature review and got to know the primary data.
2. We generated initial codes by coding the data into challenge tables.
3. We identified, discussed and concluded those data into different themes.
4. We refined and reviewed themes based on our knowledge.
5. We grouped themes and named them.
6. We presented the challenges and corresponding recommendations into three different tables: Table 2, Table 3 and Table 4.

**Survey**

### 1. Data collection

The survey was carried out in 10 companies from the IT field in China. We used questionnaire method to collect data and the questionnaires were sent out to each participant via e-mail. The survey questions were based on the results of the systematic literature review. And the survey focused on discovering the challenges of Agile teams in the practical environment (see Appendix A for questionnaire). The participants from Agile teams were randomly selected by contacting project managers in companies and they were responsible for helping us to assign our questionnaires to Agile team members. There existed biases during the process. Finally, the size of samples was 80 and we got 48 responses within 30 days.

*Questionnaire*

The questions in the questionnaire were based on the previous systematic literature review.

The questionnaire was divided into 3 sessions. Section 1 was designed to get through the basic background and information of the participants and their companies. Section 2 aimed to let participants make an overall evaluation of the decision-making process in their Agile teams on the past projects. This part helped us to make a full picture of their work in Agile. Section 3 was mainly based on challenges in literature review. In addition, there were two open questions for them to supplement the above questions.

### 2. Data analysis

After we got feedback of questionnaires:

1. We reviewed all the collected questionnaires and found if there were any empty of the questions and excluded those incomplete questionnaires in order to prevent biases. Finally, there were 46 valid questionnaires after the process of reviewing.
2. We summarized and extracted useful data from questionnaires of section 2 and section 3. We got an overall evaluation of their Agile decision-making process from section 2 and we got top challenges from section 3.

## IV FINDINGS

This section describes the findings from the above research.

**Literature Review Results**

After extracting data using parameters in Data extraction methodology, we created three challenge tables which are Team Communication Challenges, Individual Issue Challenges, and Management Challenges consisting of the following columns:

- Challenge: A descriptions of the challenge.
- Solution: Corresponding solutions to the challenges.

Overall, the area of Team Communication emphasizes the communication between group members in Agile teams. Team Communication refers to interactions between members and their group behaviors. The area of Individual issue concentrates more on the individual perspective including their mental activities or psychological state. The Management area includes all the challenges existing at the management level.

*Team Communication*

Team Communication is very important in an Agile team-based development process [16] [28] [29]. Team Communication Challenges are identified in Table 2. One challenge occurs when Agile team members are not taking ownership of decisions [16]. This challenge hinders members from communicating smoothly with each other and from knowing what others are trying to communicate. This phenomenon is attributed to a lack of experience, knowledge, competence or accountability of team members, which relates to a state of uncertainty. Therefore the solution is to help everyone remove confusion about authority during decision-making process and also clarify responsibilities [16].

Another challenge is called "Groupthink" and the Abilene Paradox is a phenomenon of "Groupthink" that hinders the Agile decision-making process [26] [27]. Going deep into the Abilene Paradox, one of the important challenges is the lack of shared understanding among team members. The lack of shared understanding includes the complexity of context and psychological drive [27]. Because team members do not have effective communication, the decision-making process deviates from the right way. Therefore, Moe [28] [29] emphasizes the importance of building a shared mental model, which is developed by negotiating comprehensive shared understandings about teamwork. Researchers suggest that a shared mental model should be developed before iteration plans are settled [28] [29]. The Abilene Paradox also makes members have a thought of "herd" and do not confront each other which finally results in another big challenge where they shift responsibilities and blame each other due to those bad decisions [26]. Hence, there is less of a free and fair communication atmosphere in the teams. In order to solve the "Groupthink" challenges, McAvoy and Butler [27] mentioned two recommendations from Janis [20]; one is forming separate groups, under different leaders, to propose solutions to

the same problems. The other one is to involve the project manager playing the role of devil's advocate, who acts as an opponent of the decision-making process by frequently questioning decisions. The devil's advocate means the project manager has the task of deliberately opposing or critiquing the decisions made by teams [26] [27].

Another challenge in Team Communication is called technocracy, which means high expert power enables super-decisions within groups [29]. In order to control technocracy, it is still suggested that all the team members should actively participate in the decision-making process to balance technocracy [28] [29].

**Table 2: Team Communication Challenges**

| Challenge | Solution |
|---|---|
| Lack of ownership | Remove confusion of authority [16]. Provide a better context for teams to exert their autonomy [16]. Make decisions visible to prevent decisions from being ignored [16] [39] [40]. |
| "Groupthink" | A shared mental model should be developed [26] [27] [28] [29]. Involve the project manager to play the role of the devil's advocate [20] [26] [27]. Separate groups should be formed, under different leaders, to propose solutions to the same problem [20] [27]. |
| Technocracy | All the team members should actively participate in decision-making process [28] [29]. |

*Individual Issue*

The challenges of Individual Issue are more deeply focused on the mental activities of team members. Table 3 shows Individual Issue Challenges. As a decision-maker, it is very important to commit to a decision. However, this type of challenge occurs when team members are unwilling to commit to a decision

and rely on the project manager (Scrum Master) for decisions [16]. Drury [16] said that the lack of commitment derives from insufficient expertise. When members lack commitment, decisions are sometimes delayed. Moe [28] [29] also states that low commitment to decisions make plans more unrealistic. Members will join another new project before the original one is done [29]. Another challenge is that individuals stop making any decisions and only rely on others for decisions, which hinders the effective implementation of the decision-making process [16]. Both the lack of commitment and ineffective implementation can be improved by organizing the planning meetings properly and also enabling everyone to participate in the decision-making process [16] [29] [34] [39]. Moreover, decision-hijacking is the next challenge for an individual, and this individual behavior means they make decisions without informing others. The recommendation to deal with decision-hijacking is to organize effective daily meetings [8] [24] [29].

**Table 3: Individual Issue Challenges**

| Challenge | Solution |
|---|---|
| Lack of commitment | Organize the planning meetings properly [16] [29]. |
| Lack of implementation | Enable everyone to participate in the decision-making process [16] [29] [34] [39]. |
| Decision-hijacking | Effective daily meetings [8] [24] [29]. |

*Management*

In the area of Management, challenges are various [7] [16] [29]. Management Challenges are shown in Table 4. Firstly, conflicting priorities for decisions are a challenge for Agile teams. Conflicting internal priorities often occur in a flat team structure but result in a confusion of which decision should be made, and when, and for whAT goals [16]. When missing clear prioritization, it is time consuming to deal with a lot of work. Missing a definition of "done" also challenges the decision-making processes that teams will not complete what is planned [29]. Therefore, clarifying prioritization and making a definition of "done" are useful to reduce

conflicting priorities [16] [29]. Secondly, unstable resource availability hinders effective decisions. Unstable staff availability is regarded as an obvious uncertainty when a participant is pulled into external tasks and these tasks cannot be completed on time [16] [29]. Besides, the team can not get adequate support and resources from the organization when there are conflicting priorities within the organization that interrupt the decision-making process [29]. It is necessary to reduce the amount of work in progress in order to control this challenge [16] [29].

Another challenge mentioned by Hilary [7] is that in a bureaucratic arena, Agile teams can not make an effective decisions. The whole organizational structure of the company influences the management structure and decision-making process [7] [15]. A bureaucratic organizational culture means a control oriented environment within a perceived blame culture. This kind of hierarchical driven structure reduces members' abilities to make decisions. People strictly conform to the hierarchical structure and the Agile team lacks self-management and there is a lack of trust between team members and managers. The challenge occurs when no one wants to make decisions because no one wants the blame attached to them if anything goes wrong. Therefore, a climate of trust and a collaborative environment can help to promote an authoritative, fast decision-making process [7] [15]. Similar to organizational culture, team orientation is also very important [16] [29]. The lack of team orientation frustrates team spirit and hampers the decision-making process [29]. The relevant solution is to develop shared beliefs, meanings and values, and a cooperative environment and company culture [7].

**Table 4: Management Challenges**

| Challenge | Solution |
|---|---|
| Conflicting priorities | Clear prioritization and a definition of "done" [16] [29]. |
| Unstable resource availability | Reduce the amount of work in progress [16] [29]. |
| Lack of self-management (Bureaucracy) | Foster a climate of trust, cooperation and collaboration in the organization [7] [15] [16] [29] [32]. |
| Lack of team orientation | |

### What is your current role on your agile team? Please tick all that apply and circle your main role.



Legend:
- Technicist/Developer
- Tester
- Technical Architect
- Scrum Master/Project Manager
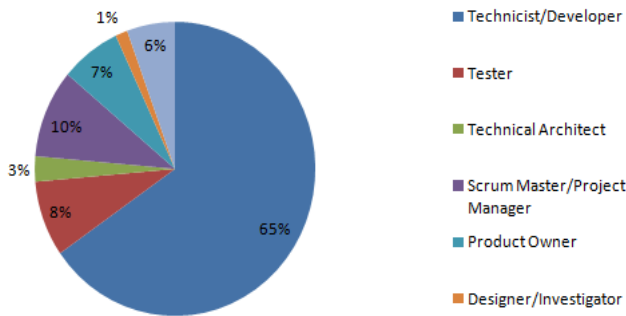- Product Owner
- Designer/Investigator

**Figure 3: Roles in Agile teams**

who are Scrum Masters or Project Managers and other roles account for the remaining 28%. The Table 5 shows that respondent' overall evaluations of the decision-making process in their Agile teams.

From the table, it shows that all of Agile team members have a good impression of decision-making process in their Agile teams in Chinese companies. They think highly of the communication and team performance and most of them are satisfied with the way of implementing the decision-making process in their companies.

**Table 5: Overall Evaluation**

| Question | Excellent | Above Average | Average | Below Average | Weak |
|---|---|---|---|---|---|
| What do you think about the decision-making process in your Agile team? | 31.25% | 47.92% | 20.83% | 0% | 0% |
| How does the team communicate during the decision-making process? | 29.17% | 35.42% | 35.42% | 0% | 0% |
| How is the team performance? | 20.83% | 52.08% | 27.08% | 0% | 0% |

The pie chart, Figure 3, shows the percentage of respondents in each role in their Agile teams. We can see that 65% of the respondents are developers or technicians and there are also 10%

**Figure 4: Perceptions of Decision-Making Process**
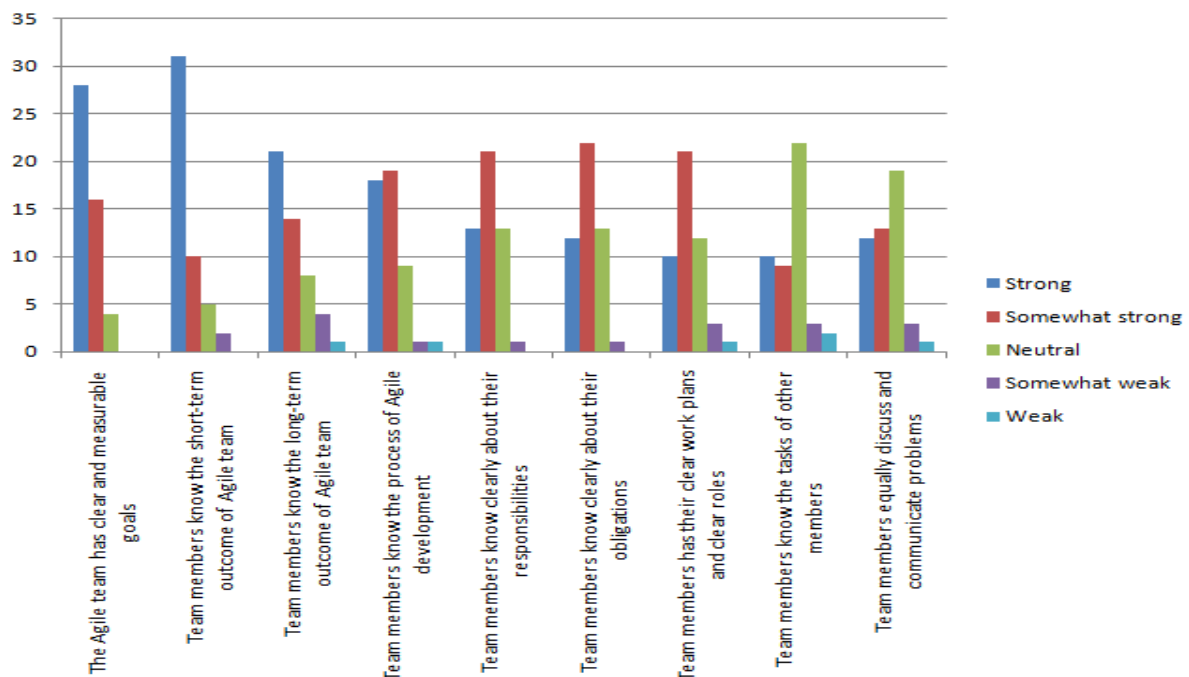
The bar chart, Figure 4, shows their perceptions of the Agile decision-making process from different perspectives. We used "Strong" and "Somewhat Strong" to represent the positive status and "Weak" and "Somewhat Weak" to represent the negative status.

58.33% answered strong and 33.33% answered somewhat strong to the statement of "The Agile team has clear and measurable goals". 64.58% of respondents answered strong and 20.83% answered somewhat strong to the statement of "Team members know the short-term outcome of Agile team". 6.25% and 4.17% of respondents separately answered weak and somewhat weak and very few respondents answered strong to the statement of "Team members know the tasks of other members" and there also some respondents (6.25% and 2.8%) who answered weak and somewhat weak to the statement of "Team members equally discuss and communicate problems.

As visualized in the bar chart Figure 5, some challenges are supported by a majority of respondents but some challenges are not so agreed by respondents.

The top challenges that are agreed upon by an overwhelming majority of the respondents. "Agile team members are unwilling to commit to a decision and rely on the Managers/Scrum Masters for decisions", which is 56.25% strongly agreed and 27.08%

agreed by respondents. 91.67% of the respondents said that the teams face conflicting priorities to make decisions. 89.59% said that decisions are based on unstable resources, while 75% of the respondents said that Scrum Master enforces personal willingness to the process (such as bureaucratic, autocratic or undemocratic) was the most important thing. Other challenges "Agile team members do not collaborate well (such as communication problems or distrust each other)" and "The negative attitude of members hampers the decision-making process (such as absence of meetings, low completeness of tasks)" are also agreed by most of respondents. However, the two least agreed upon statements are "Agile team members do not implement decisions and are relying on others for decisions" and "Agile team members do not take ownership of decisions despite Agile team autonomy".

*Contradictions*
Interestingly, contradictions exist between these results. All the members personally response positively in the survey but they still agree that they face different kinds of challenges during their Agile decision-making process. For instance, members choose very well about their team communication during the process and they all think their teams perform well.

**Figure 5: Challenges Surrounding Decision-making Process in Agile Teams**
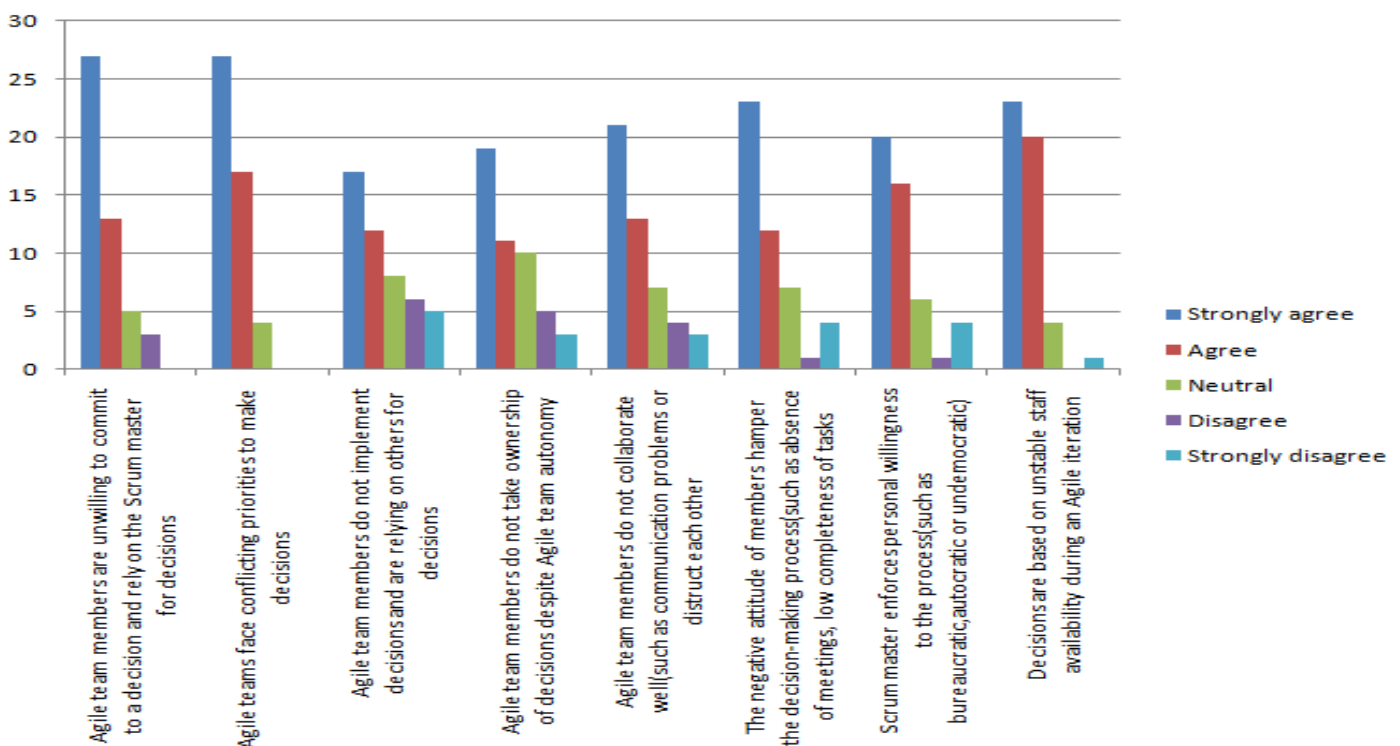
However, in their perceptions of decision-making process, they know little about each other's tasks and they think it is weak of their equal communication. They also regard the lack of commitment and communication as important challenges. From these contradictions, Agile members actually do not have as good communication as they think. This phenomenon shows that members are accustomed to overestimating the performance and outcomes of the whole team under certain pressure but in fact challenges still exist and can not be ignored. Maybe they express their ideas more objectively in the in-deep explorations in challenges and perceptions. There seems to be contradictions in the way they think.

## V DISCUSSION

Based on the synthesized results from the systematic literature review and survey, we outlined five main challenges in Chinese companies according to the following steps: Firstly, based on challenges [16] [28] [29] in section 3 in the survey, we analyzed and grouped challenges and extracted keywords to summarize each type of challenges: Commitment, Priorities, Unstable resources, Bureaucracy, Communication. Secondly, we corresponded the five keywords to the three themes of challenges (Team Communication, Individual Issue, and Management) from the systematic literature review. Finally, we synthesized the most common challenges from the Figure 5 in Chinese companies as below.

### 1. Commitment

Agile team members are unwilling to commit to a decision and rely on the others. This challenge corresponds to the area of Individual Issue in our systematic literature review, team members unwilling to commit to a decision are the most important challenge in Chinese companies. This phenomenon happens frequently in both small-medium and big companies. Based on feedback from the questionnaire, the similar commitment issues include members not wanting to commit to decisions because of lack of expertise or interest. This problem exists equally significant in both small-medium and large companies.

### 2. Priorities

Agile teams face conflicting priorities to make decisions. This challenge refers to the Management area. Chinese companies face challenges to deal with conflicting priorities. The conflicting priorities make members confused about their responsibilities and goals in decision-making process. Survey results show that members sometimes are not clear about their responsibilities and goals of teams and they do not know well about the prioritization of their tasks. It means that teams can not complete tasks as planned. The challenge is also equally significant either in small-medium or larger companies.

### 3. Unstable resources

This challenge means that decisions are based on unstable resources. This is another important challenge corresponding in the area of Management in Chinese companies. Some uncertain elements impede the decision-making process and teams can not get enough training and support from organizations and they have to interrupt decision-making process. This situation occurred in four large companies as we surveyed. Members in large companies face unstable resources availability which result in an incompletion of the work. This challenge also happens occasionally in small-medium companies. The members feel frustrated when there is lack of support and the whole decision process can not go further.

### 4. Bureaucracy

As for another Management challenge, Managers forces his/her will on everyone (such as bureaucratic, autocratic or undemocratic), which is highlighted. This challenge is how to overcome the bureaucratic structure in teams. Most Chinese companies use a relatively high hierarchy driven structure, of which the working pattern is operating on "one person, one job" [7]. The survey results show that some Chinese companies have challenges with interference of managers in Agile teams. It is based on the Chinese organizational culture. In some companies, the blame culture from strict hierarchy in companies influences the decision-making process. Some respondents to the survey complain about the changeable thought of Scrum Master or managers and they have to conform to the decisions of what managers desire to make. This kind of structure is contrary to Agile development. The challenge is even more serious in some small private companies. In small-medium companies, the power of high level management seriously changes the way of decision-making process in Agile teams. This challenge is in agreement with the related research, which shows that Agile development requires developers to make decisions independently. Therefore, the autocratic is a

big challenge in Agile decision-making process.

### 5. Communication

Agile team members do not collaborate well (such as communication problems or distrust each other). The negative attitude of members hampers the decision-making process (such as absence of meetings, low completeness of tasks). These challenges refers to Team Communication, in Chinese companies, most Agile team members perform well in the decision-making process and are willing to participate in the decision-making process. However, Agile teams still face communication challenges in teams. The "Abilene Paradox" of Groupthink is reflected from the survey results. Historically, China's prevailing philosophy has been one that preaches "peace is most precious", "harmony without uniformity" [13]. This is why Chinese people often do not want to confront each other and keep their views to themselves. In the long-term, it can make team members distrust each other and create a negative attitude within teams. Survey results also show that sometimes team members know little about others' tasks and only concentrate on themselves. The interaction between teams is very little and decision-hijacking and technocracy from others occur and it is hard to build a shared understanding. This here shows a high level of agreement between related research and our data. The Agile concepts and practice has been widely disseminated and adopted in China but the respondent still faces communication problems.

There are still differences between survey results and literature review. Agile team members do not implement decisions and Agile team members do not take ownership of decisions. These two challenges are least supported by respondents in the survey results, and team members in Chinese Agile teams are often active in participating decision-making process and they often have enough experience to take ownership of decisions. However, this challenge still exists in part of Chinese companies. Some respondents also wrote in the questionnaires that they complained about the lack of motivation for participating in decision-making process, which badly impeded Agile decision-making process and self-management teams.

## VI RECOMMENDATIONS

In this section we provided suggestions that can help mitigate the challenges reported in this article by some SW practitioners in order to improve the Agile decision-making process. We concluded and summarized some recommendations in three themes mentioned in the previous systematic review (Team Communication, Individual Issue, and Management) to improve the Agile decision-making process and these recommendations are generally suitable in all the Agile teams.

When dealing with challenges in Team Communication. We think it is necessary to involve the project manager taking on the role of devil's advocate [26] [27]. As a devil's advocate, the project manager is responsible for deliberately opposing or critiquing the decisions made by teams. This can be used to control Groupthink ("Abilene Paradox") in Agile teams. Understanding the boundaries of decision-making in Agile teams is very necessary, which helps to remove confusion over who is responsible for implementing decisions, and it is useful to exert Agile team's autonomy [16]. We propose that all team members should be able to participate in the decision-making process to avoid technocracy and developers need to be included in the whole process [29]. It is suggested that making the decisions visible that can prevent decisions from being ignored [16]. Researchers suggest that developing a shared mental model by reaching an agreement on shared understandings [29], which can avoid unrealistic plans and increase member's commitment to decisions.

As for Individual Issue, we think the planning meetings and effective daily meetings should be well planned and the Agile teams should enable everyone to participate in decision-making process to prevent decision-hijacking. Both short-term and long-term goals must be clearly aligned to reduce members' confusion [29] and decisions should be also categorized explicitly into tactical and strategic decisions [16], which improve a team's overall decision-making ability.

To address Management challenges, we think it is also important to define a clear prioritization and a definition of "done" when facing conflicting priorities [16]. It is better for Agile teams to reduce the amount of work in progress when they face unstable resources. When some uncertainty happens, e.g. unstable resources, or difficulties to understand the work, there is a need to shorten or reduce the tasks accordingly [29]. It is necessary to build

an organizational culture that builds redundancy and solve all the related problems at daily meetings to avoid biases within Agile teams [29]. Companies should also try to create a climate of trust, cooperation and collaborative organizational culture [7], which promotes the spirit of team orientation and trusty of each other.

## VII LIMITATIONS AND FUTURE RESEARCH

There are certain limitations in our research. In the systematic literature review, we may have missed some valuable papers in the field of Agile decision-making process. It is possible that papers present interesting points and thoughts in other languages. We may miss some important keywords when we search for papers.

In addition, as for survey research, there are a few limitations to ensure the accuracy of the survey results. The questionnaire is subjective and respondents may not answer truthfully and accurately. Moreover, the problems of personal inhibitions, indifference and unawareness of the nature make survey results invalid or inaccurate. In addition, the research doesn't cover any specific Agile decision-making process i.e. Scrum, XP, which may lead to slightly difficulties in our research.

*Future research*

In future research, we would go further into the Agile decision-making challenges. And the settings can be transferred into different cultures to identify and compare different challenges among China, US, and European countries, when it comes to Agile decision-making process. Moreover, IBM is a global company and more global companies can be investigated to find challenges in their distributed projects, therefore there is also a future research about understanding the decision-making process when applying Agile practices in global software.

## VIII CONCLUSION

This empirical research explores the decision-making process in Agile software development. Our research questions focus on Agile decision-making challenges in Chinese companies and on improving the decision-making process.

Based on the synthesis of literature review and survey results, our main finding is that Agile teams in China have problems with Commitment, Priorities, Unstable resources,

Bureaucracy, and Communication. Although this differs from the results of the literature review, more research is needed to understand the differences.

In general, we believe that our research also has a few important implications for practice. We summarize empirical recommendations to help companies improve their Agile decision-making process. These recommendations provide better guidance to all companies in the practical environment.

## IX ACKNOWLEDGEMENTS

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## XI APPENDICES

Appendix A

**Session 1: Basic information**

1. What is the name of your company?

2. What is the number of employees in your company?
☐ Below 25
☐ 25 - 50
☐ 52 - 100
☐ 101 - 200
☐ Above 200

3. What is your department?

4. What is your current role on your Agile team? Please tick all that apply and circle your main role.
☐ Technicist/Developer
☐ Tester
☐ Technical Architect
☐ Scrum Master/Project Manager
☐ Product Owner
☐ Designer/Investigator
☐ Manager
Other_____

5. How would best describe your team type?
☐ Small collocated teams
☐ Large collocated teams
☐ Distributed teams

6. How long your team adopt Agile software development?
☐ Under 1 year
☐ 1 - 2 years
☐ 2 - 3 years
☐ 3 - 5 years
☐ Above 5 years

7. What is the Agile methodology that you team adopt? (Multiple)
☐ Dynamic systems development method (DSDM)
☐ Crystal family
☐ Scrum
☐ Adaptive software development (ASD)
☐ Feature driven development (FDD)
☐ Extreme programming (XP)
☐ Pragmatic programming (PP)

**Session 2: Perceptions of Agile team**
**Please according to your own valuable experience on the past projects, evaluate your perceptions of the decision-making process.**

8. What do you think about the decision-making process in your Agile team?
☐ Excellent
☐ Above Average
☐ Average
☐ Below Average
☐ Poor

9. How does the team communicate during the decision-making process?
☐ Excellent

☐Above Average
☐Average
☐Below Average
☐Poor

10. How is the team performance?
☐Excellent
☐Above Average
☐Average
☐Below Average
☐Poor


**Please according to your valuable experience, evaluate the following items.**

11.                              Strong  Somewhat strong   Neutral Somewhat weak  Weak

The Agile team has clear
and measurable goals

Team members know
the short-term outcome of
Agile team

Team members know
the long-term outcome of
Agile team

Team members know
the process of Agile development

Team members know clearly about
their responsibilities

Team members know clearly about
their obligations

Team members has their clear
work plans and clear roles

Team members know
the tasks of other members

Team members equally discuss and
communication problems


**Session 3: Challenges**

12. What do you think of the challenges during the decision-making process?


Agile team members are              Strongly agree     Agree      Neutral  Disagree  Strongly agree
unwilling to commit to a
decision and rely on the scrum
master for decisions

Agile teams face conflicting priorities

to make decisions

Agile team members do not implement
decisions and are relying on others
for decisions

Agile team members do not take ownership
of decisions despite Agile team autonomy

Agile team members do not collaborate well
(such as communication problems or distrust
each other)

The negative attitude of members hamper
the decision-making process (such as absence
of meetings, low completeness of tasks)


Scrum master enforces personal willingness
to the process (such as bureaucratic, autocratic
or undemocratic)

Decisions are based on unstable staff
availability during an Agile iteration

13. What do you think are the challenges during decision-making process in your Agile team?

14. Is there anything we haven't covered that you feel is important to know about how your team makes decisions during Agile development?
_____