AGILE TRANSFORMATION: A MULTI-DIMENSIONAL PROCESS

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Graphical abstract
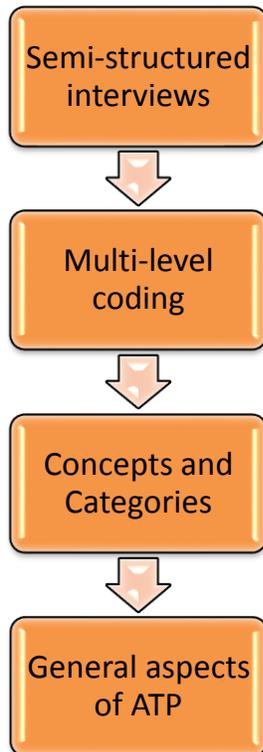
Abstract

Software companies are widely interested to use Agile methodologies instead of traditional methods, mainly because of achieving the values offered by Agile approach. However, literature review implies that the alteration process is subject to various serious challenges that make Agile transformation more difficult than expected. Most of the companies are facing these challenges mainly because of the lack of knowledge and understanding of the transformation process. We have conducted a large-scale empirical research study discover various aspects of Agile transformation. Applying a Grounded Theory study identified the general outline of Agile transformation Process. The main aim of this paper is to illustrate the most important concepts that need to be considered when adopting Agile methodologies. This study showed that Agile transformation comprises many concepts, activities, and steps including transformation prerequisites, facilitators, framework, assessment, coaching, and so on. Software companies and organizations need to be familiar with these concepts before inception of Agile transformation process.

Keywords: Agile software development, agile transformation, agile transition, agile methods, grounded theory

Abstrak

Syarikat perisian berminat untuk menggunakan kaedah *Agile* secara meluas berbanding kaedah tradisional, terutamanya kerana mahu memperoleh nilai-nilai yang ditawarkan oleh pendekatan *Agile*. Walau bagaimanapun, kajian literatur menunjukkan bahawa proses perubahan itu adalah tertakluk kepada pelbagai cabaran yang serius yang membuat transformasi *Agile* lebih sukar daripada yang dijangkakan. Kebanyakan syarikat sedang menghadapi cabaran-cabaran terutamanya kerana, kurangnya pengetahuan dan pemahaman mengenai proses transformasi. Kami telah menjalankan kajian penyelidikan empirikal berskala besar dan telah meneroka pelbagai aspek transformasi *Agile*. Teori Asas telah digunakan bagi mengenal pasti gambaran am mengenai proses transformasi *Agile*. Tujuan utama kertas kerja ini adalah untuk menggambarkan konsep yang paling penting yang perlu dipertimbangkan apabila menggunakan kaedah *Agile*. Kajian ini menunjukkan bahawa transformasi *Agile* terdiri daripada banyak konsep, aktiviti, dan langkah-langkah termasuk prasyarat transformasi, fasilitator, rangka kerja, penilaian, bimbingan, dan sebagainya. Syarikat perisian dan organisasi perlu membiasakan diri dengan konsep-konsep ini sebelum memulakan proses transformasi *Agile*.

Kata kunci: Pembangunan perisian agile, transformasi agile, peralihan agile, kaedah agile, teori asas

1.0 INTRODUCTION

Software industry is rapidly replacing traditional software development by Agile software development. Although various reasons can be considered to do alteration, the most important reason is the inherent problems of traditional methods in software development [1, 2].

In contrast to the disciplined or traditional methods, Agile methods are low ceremony, people-centric, less formal, iterative, and collaborative-based [3]. Agile methodologies promise higher product quality, faster return on investment (ROI) by early and frequently delivery, minimum documentation, more development visibility, embracing requirements changes even in the final stages, lower time to market, and providing more transparency to customers, etc. [3, 4].

Agile transformation or transition process (ATP) is known as the process of leaving traditional software development methods and adopting Agile software development methods. Unlike its simple concept, ATP is not an easy and smooth process and generally, is subject to many challenges and issues [5]. The rationale behind these challenges is the fundamental differences between disciplined and Agile software development processes so that each of them has focused on different values and practices.

Several studies have been carried out to introduce Agile methods to software companies. These studies have reported different aspects of ATP, primarily because their main focus has been on only some particular dimensions of transformation process. While most of them have reported the challenges experienced by software companies, a few of them have proposed theoretical framework to utilize Agile adoption and transition [6]. However, there is no well-known transformation framework in-line with Agile approach [6].

We have conducted a large scale empirical research study to explore various aspects of ATP [7, 8]. Due to the people-centric nature of Agile methods, conducting an empirical study could help us to explore the most significant issues that companies would face during ATP.

The rest of this paper is organized as follows: Section 2 provides a short background on Agile software development and transitioning to Agile methods. Section 3 briefly describes adopted research methodology, followed by Section 4 that explains the general outline of ATP, as the findings of this study. Section 5 presents a brief discussion on the emerged concepts. Section 6 briefly shows the related works regarding the emerged categories and concepts, and finally, Section 6 concludes the paper.

2.0 AGILE TRANSFORMATION

So far, various Agile methods have been introduced in which some of them have focused on software development and some others on project management. The most famous Agile methods are Scrum, extreme programming (XP), Crystal Family, Test Driven Development (TDD), Dynamic System Development Methodology (DSDM), Feature Driven Development (FDD), Kanban, etc. [4]. The main focus of some of them is project management while other emphasize on software development. For instance while XP focuses on software development, Scrum totally stressed on software project management [9]. Each Agile method has its own particular practices and life cycle, but they follow the same values addressed in Agile manifesto and the principles behind it [10].

Agile transformation is a socio-technical process that leads to a huge change in organizational and technical practices in software companies [11]. Hence, ATP needs extensive changes in various aspects of a company.

The real reason that makes ATP more difficult than expected is that a true ATP must focus on being Agile rather than doing Agile. Indeed, Agile adoption is not only following some specific practices defined by Agile methods.

Software companies and organization are facing with many obstacles, challenges, and problems when adopting Agile methods. The majority of reported challenges are related to human aspects of ATP [12]. This is mainly because Agile methods are known as people-oriented processes, so that, most of the researchers believe that ATP is nothing unless changing people's behaviors, cultures, attitudes, and mindsets in software development process. People-related challenges are those which experienced by team members, project manager, and middle and senior managers in software companies. Also, it can cover customer-related challenges as well [13].

Beside human-related challenges, tools and technology related issues have been reported in many research studies too. However, these type of challenges are less critical and important compared to the human-related ones [11].

Reviewing the literature shows that besides the aforementioned challenges, many other issues must be considered before starting ATP. The obstacles and challenges that have been reported by various research studies show that the scope of ATP is not limited to specific parts of organization. Therefore, various factors have to be considered carefully when studying ATP [14]. For instance, selection of the initial Agile project, called pilot project, is one of the critical success factor in ATP [15]. Another important thing is the different roles and responsibilities of people in traditional and Agile methods. This fact also can be found in the literature where most of the success factors of the transitioning to agile are directly associated with people attitudes and behaviors [16, 17].

3.0 ADOPTED RESEARCH METHODOLOGY

Obviously, choosing the right research methodology directly impresses the quality of findings. In this study, Grounded Theory (GT) has been adopted as our choice of research methodology. GT is a qualitative research methodology which involves a systematic process to discover a grounded theory[1] based on substantive data [18]. Such a theory would be enough grounded in data and reflects the reality of the area under study in a scientific manner.

GT assists the researchers to answer questions like "what's going on in an area?" and facilitates building substantive or formal theory of realities under study [19]. We found that this research methodology is very helpful in finding unclear or new concepts in Agile software development [20]. The rationale behind choosing GT as our choice of research methodology was the similarities between GT and Agile software development as follows [21]:

- both are incremental and iterative in nature
- both adhere to conduct minimum initial planning
- both emphasize on the human and social factors

GT strongly recommends refraining from formulating a research problem or hypothesis up-front in order to effectively uncover and identify main concerns of the participants [18]. The main rationale behind this advice is that (1) the research problem should be the participants' problem and should not be forced or preconceived, rather it should be allowed to emerge freely; and (2) GT is used to build new theory, and in case of having a preconceived specific research problem, a researcher will be limited in his explorations [18]. Therefore, this study has been started with general questions to allow the participants freely express their concerns regarding the moving to Agile and adopting Agile practices, as previously mentioned.

Starting from grounded data, GT multi-level coding procedure assists researchers to achieve a high-level abstract theory at the end of GT procedure, as depicted in Figure 1.
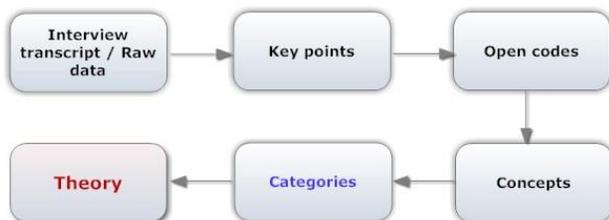
Figure 1 Multi-level coding in GT

Since we have described the process in our previous publications e.g. [5, 7, 8, 12, 14, 20, 22-24], this paper only addresses the most important points regarding to the adopted research methodology.
We have conducted a large-scale GT with participation of 49 Agile experts from different

companies in 13 different countries across the world. About half of the participants were Agile coaches and consultants that had helped several companies to do their transformation process. Their experiences in ATP were a valuable resource to study this process. The main focus of this study was exploring different aspects of ATP. Therefore, participation of various individuals with different backgrounds and roles was a critical requirement. Furthermore, having participants form different companies, countries, and cultures was a great opportunity to consider human-related and cultural issues in ATP. These could lead to more precise results supported by different perspectives. Typically, a GT creates a huge amount of results in form of different categories, as defined in GT procedure [19]. Hence, most often GT researchers need to publish different parts of their findings in different papers.

We have conducted 49 online semi-structured interviews with the volunteer Agile experts participated in the study. The interviews started with general questions about participants' background, their experience of Agile transformation, the problems and obstacles they faced with and their solutions or suggestions regarding those challenges. The next series of questions focused on the various aspects of ATP. However, as GT expects, we did not ask any direct questions regarding specific concepts or issues [25]. All the interviews were voice recorded with the consent of the participants and transcribed immediately in order to use for further analysis in the next stages.

Categories are one of the artifacts of GT that represent a series of concepts that are related to each other [18]. Using constant comparison technique - a method in which new emerging code is constantly comparing with the previous emerged codes in the same of previous interviews – the emerged categories are compared and may new categories emerge (in a higher level of abstraction) [18]. Eventually, the core category that reflects the main concern of the participants will emerge [18]. Identifying this category is the real aim of A GT study. The final theory often shows the area under study in a high level of abstraction. Such a theory is helpful to show main concern of participants in real environments. However, sometimes initial findings are also very helpful, primarily in order to highlight the detail of the phenomena under study. This approach is especially valuable to explore all aspects of a socio-technical phenomenon, like Agile transformation.

4.0 GENERAL FINDINGS: VARIOUS ASPECTS OF ATP

The final theory emerged in this research study was "Agile transition and adoption process". However, in this paper, we do not discuss the final theory. The rest of this paper describes only the outline of the findings

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[1] "Grounded Theory or GT" refers to the research methodology and "grounded theory" refers to the outcome of the research methodology as a final theory.

in terms of the emerged categories. In fact, what we contribute is this paper, are the most important concepts and categories that collectively describe ATP. Interested readers may find detail of the theory in [8].

As explained before, these categories came directly from the grounded data. Therefore, they will show the reality of Agile transformation in practice. Although these categories are not matured in this level, they are very helpful to show the various aspects and dimensions of transitioning to Agile. This could be very helpful for those companies who intend to start their transition to Agile.

Figure 2 shows the emerged categories we found out in early stages of the GT. Each category reflects a major concern of the participants. However, in next stages, some of them combined or coded in different ways to reach higher level of abstraction during theory generation phase. In Figure 2, the closed circles show the most important categories. It means that the participants mainly focused on them during data collection phase.

It should be noted that due to incrementally evolution of a grounded theory, importance or priority of the emerged categories may change with receiving more data. The above categories are those which appeared before starting selective coding –when GT researchers focus on the core category and its related categories only and leave the others [18].

The next section provides a short discussion on the above categories and shows how they are important within Agile transformation process.

5.0 DISCUSSION

Due to the space limitation, each category is only explained in brief. However, briefly explanation of each category is difficult mainly because of huge amount of the data related to each of them.

Category '*prerequisites*' shows the important Agile transformation prerequisites. Various prerequisites have been addressed during the data analysis. The most important prerequisites are people commitment to change, providing initial training, defining business goals, pilot project selection, having convincing reasons for change, team set up, and pre-start up assessment. Some of the prerequisites focus on managerial perspective of Agile transformation (e.g. having business goals), Other prerequisites focus on preparing organization and teams for Agile transformation (e.g. providing initial training). The participants stress providing the prerequisites before starting the transition process. By providing the mentioned prerequisites, software companies and organizations can avoid most of the obstacles and overcome the potential problems during the transformation and ultimately increase their chance of success.
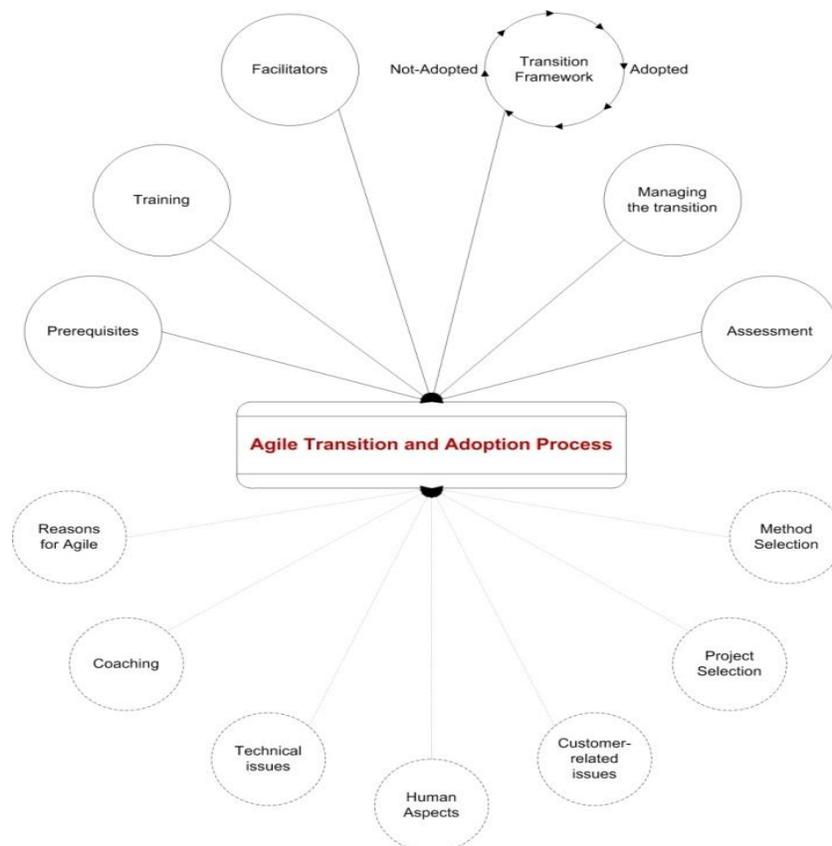

Figure 2 The emergence of different categories reflecting various aspects and dimensions of Agile transformation

'Training' was another important category emerged during GT process. In initial steps of the study, it seemed that training is the most important concern of the participants (the core category of the study). However, we found out another concern as the core category in next stages of data coding. A major part of the findings describe role of training and explain how inadequate and dysfunctional training impresses the transition process [7]. Most of the participants stressed on providing training before and during transformation process. It seemed that lack of enough training was one of their serious reasons of their problems and challenges when moving to Agile.

'Facilitators' shows the most important ATP facilitators which their existence support and facilitate ATP. The participants believed that such facilitators are critical success keys in transitioning to Agile. They addressed various facilitators including good coaching and mentoring service, effective, on-site, and comprehensive training, Agile champions, providing incentive factors, people buy-in, selecting right people and empowering team members, and continuous meetings and negotiations. Providing these facilitators has significant effects on facilitating transformation process. Nonetheless, as the participants expressed, for various reasons, providing all of the facilitators may not possible in all stages of ATP. Details of this part of the findings have been explained in [26].

'Transition framework' represents the transition framework which can be employed for transitioning to Agile. This framework provides a stepwise procedure that is enough simple and flexible to be used in software companies and organizations regardless of size [8]. Most of the participants explained that they had not used any transition model, framework or even an action plan to do ATP. The emerged framework in this study is iterative in nature that is in-line with Agile approach. Furthermore, they also confessed that lack of the transition framework led many challenges problems during their ATP.

'Managing the transition' focuses on importance of the handling transition-related issues and managing the required steps. It also focuses on strategies that can be considered as the transition choices such as partial transition and adoption, tailoring, etc.18. The participants explained that an important issue in managing ATP is identifying the potential challenges and issues. Focusing on people-related issues and timely problem handling has been addressed as the most important strategies to cope with the potential problems during ATP.

'Assessment' mainly describes the points in which assessment needs to be applied. Data coding showed that in many stages assessment needs to be done. For instance, before starting the transition, organization needs to be assessed in order to verify its readiness for the transition. The result of the pre-start up assessment helps companies to find their weaknesses regarding to ATP. Also, assessment in several other points has been stressed by the participants including preparing training programs, assessing adaptation to Agile practices in the transition framework (i.e. agility assessment achieved by company), etc.

'Reasons for Agile' comprises the real reasons that software companies and organization believe that Agile approach is helpful for them. The participants explained that without having convincing reasons for going Agile, ATP would be a useless effort. They mainly emphasized that companies have to define clear business goals before starting the transition in such a way that Agile transformation can help them to achieve these goals in the right time and manner. The participants addressed various common reasons including need for quick feedback, problems with traditional methods, customer dissatisfaction, improving business process, need for faster delivery, etc.

'Coaching' shows the role of coaching and mentoring service required in ATP. Coaching and mentoring needs to be provided before and during the transition. As the participants explained, role of an Agile coach is different with other software coaches primarily due to the socio-technical nature of ATP. They also expressed that most often Agile coach are responsible for training too. Coaching and mentoring in Agile methods are also different from traditional methods. Good coaching and mentoring can bring 'leadership' concept to Agile methods [27]. A good coaching service was addressed as one of the success factors of the transitioning to Agile.

'Technical issues' mostly addresses the most important problems regarding tools and technology when team members start practice adaptation. Adapting to Agile, like any new process, often need to be supported by some particular tools and technologies. Therefore, facing the technical challenges is an inevitable consequence of the process change. The participants mainly addressed some technical challenges regarding to technical Agile practices such as automated unit testing, continuous integration, 10 minute build, etc. However, they addressed that software companies have less problems with tools and technologies compared to other issues in ATP.

'Human aspects' describes the most important human-related issues that effectively influence the transition process. The scope of human issues is vast and covers both negative and positive factors. This part of the findings seemed to have a good potential to be studied more in detail by receiving more data. However, later this part reached to a proper maturity level [12]. This part of the findings also showed that people-related issues (team members and managers involved the transition) strongly affect the transition. It is a fact that ATP is more a social process than technical process. This led to emerging many concepts regarding human issues.

'Customer-related issues' addressed the most important challenges related to the customers. Most of the problems were related to the customer attitude/behavior/culture and a few to the business

part. Customer collaboration as one of the Agile requirements was reported as one of the serious challenges in real environments. Also, lack of knowledge was another important issue regarding customers. Data analysis showed some negative aspects of ATP related to customers and their roles in the change process.

'Project selection' stresses the importance of picking an appropriate pilot project for starting the transformation. Data analysis revealed the most important features of the a pilot project and showed how choosing a good pilot project can lead to successful transformation [15]. The participants explained the main feature of a good pilot project. Some of the participants believed that pilot project is better to be a training project. In contrary to this group, some others stressed on starting ATP with a real project. However, both groups believed that such a project should not be a very critical project. Paying attention to size of the initial project was also another issue in this category.

'Method selection' was the last important category in the initial stage of data analysis. The participants declared that selecting appropriate Agile method(s) is a critical decision. Software companies and teams need to perform an initial assessment to find out their abilities and weaknesses, and then select to the best choice of Agile method based on the assessment results. Obviously, choosing the most appropriate method would help them to achieve their goals more quickly and smoothly. For instance, when most of the pains are related to the project management, Scrum would be a good choice. However, customer collaboration is a necessary requirement for this method. The above categories describe the whole process of Agile transformation process and software companies and organizations who intend to move to Agile need to consider all of them. Reviewing the above categories shows that this process is not a simple and easy process, as software companies and teams expect, and needs to be managed carefully. The final theory of Agile transformation contains some major parts including transformation prerequisites, facilitators, transition framework, etc. [8]. It also shows how software companies and teams do their transformation to Agile methods and practices. Some aspects of this theory have been published and the rest parts are in-press, as previously addressed.

6.0 RELATED WORK

Reviewing the literature showed that the above findings are supported by previous studies. However, there is no study that to cover all of them together. In fact, most of the previous studies only address a few of the categories based on their focuses. Indeed, most of the previous studies explained their experience of Agile transformation and shared the lesson learned from ATP.

Some of the studies indentified important prerequisites of the transition. They emphasized that without providing prerequisites such as people buy-in and interest, defining business goals, team setup, etc. Agile transition and adoption will face with many problems [11, 13, 16].

Many studies addressed training as a critical factor that strongly impresses the quality of ATP [28, 29]. Training also has been addressed as one of the critical driver of Agile adoption and as a problem solving tool during the change process [30, 31]. Furthermore, lack of effective training was addressed as one of the critical risks and challenging areas of ATP [32, 33]. Some other studies also focused on practical and comprehensive training [30].

Providing the transition facilitators has been emphasized by many studies. Regardless of type, transition facilitators increase chance of success in moving to Agile. These studies addressed several facilitators including Agile champion, good coaching service, providing incentives and motivations, right people selection, etc. [34-36].

A few studies have proposed some transformation frameworks [37, 38]. However, their frameworks are subject to serious criticisms mainly because they are not flexible as Agile expects and due to less compatibility with Agile approach [6]. Most of the proposed transition frameworks are following CMMI approach. They define several levels of agility and force companies to accept this approach and adapt to the practices in each level [39].

Managing ATP was not studied directly yet. However, some of the studies described some issues to be considered when managing the transition [11, 40].

Many studies also addressed the role of assessment activities when introducing Agile methods to companies. They emphasized that assessment tasks lead to more success and less risk [41, 42].

Having convincing reasons for Agile has been emphasized by previous studies. They mainly stress having a clear vision and organizational and business goals [3, 39]. Those teams and companies that have no good reason(s) to change their development approach, have less enthusiasm to deal with the challenges of the alteration process.

Coaching service also was addressed in some of the previous works [21, 43]. Good Agile coaching service can help software teams when facing the transition challenges. Previous studies stressed on on-site and full time coaching service [21, 43]. Also, lack of this service was one of the serious reasons that teams are faced the transition challenges [29].

Although there are some technical issues in Agile transformation, reviewing the literature shows that technical challenges are not very serious [35, 44, 45]. The most important challenges were related to using new tools to support Agile practices such as continuous integration, Test Driven Development, etc.

Human issues of Agile transformation have been studied more than other issues and different issues have been addressed related to this area [11, 46]. People's perception of Agile, as a magic bullet,

makes ATP more difficult. Also, most often people resist against change of their roles in development process [13].

Some studies focused on the customers and their roles in Agile software development. They showed that without customer involvement and collaboration Agile methods do not work well as expected [47, 48]. This is primarily because customer would be a development team member in Agile approach. Agile customers have to effectively work with development team help them to achieve the most possible business value.

Although picking a proper pilot project is a critical issue, there are only few evidences about it in the literature whereby they mainly described the characteristics of the pilot project and its role in Agile transformation [49, 50]. This study identified the most important issues about pilot project and showed how choose a good pilot project facilitates ATP and increases chance of success.

Choosing the right Agile methods has been addressed as an important task for going to Agile. Several studies have focused on method selection and its role in achieving goals of the transition [51, 52]. They explained that software teams and organizations have to consider their limitations and abilities before inception of ATP. This can help them to choose the most suitable method(s) to adapt.

In general, the findings of this study reveal hidden or less known aspects of the Agile transformation comparing to the previous works. The rationale behind this is that none of the previous studies focused on whole process of the Agile transformation. Clearly, these findings have several implications for theory and practice. Software companies have to consider the reality of ATP and pay enough attention to its various aspects to avoid the potential challenges they may face during the alteration process. Obviously, such a critical process needs a clear and perfect plan before inception and needs enough support and commitment.

7.0 CONCLUSION

Conducting a large-scale GT study revealed the most important aspects of Agile transformation process. Although this paper does not explain all the aspects in detail, addressing the most important aspects would be very helpful. Software companies and teams need to increase their knowledge and understanding of ATP. Various aspects and dimensions of the transition cover many concepts including prerequisites, facilitators, transition framework, managing the change, training, etc.

Most of the emerged concepts seem to be related to each other and more data analysis assists to discover their relationships and can lead to emerging new concepts by combining the existing ones. This leads to reach a higher abstraction level. However, the initial findings are more helpful for

companies to prepare an action plan to handle them successfully.

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