How Agile Are You Thinking? – An Exploratory Case Study

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ABSTRACT
Agile software development methods reduce project costs and development time by simultaneously enhancing quality. But despite these advantages, agile principles are rarely adopted by the whole organization. In order to gain a deeper understanding of this issue, we conducted an initial exploratory qualitative case study in one medium-sized company. The goal of this study was to find out whether this company is "thinking" agile or traditional. Although we discovered a tendency towards an agile way of thinking, we identified several factors where the way of thinking remained traditional among management as well as employees. Our study reveals that cost-related aspects, a lack of self-responsibility, uncertainty with customer interaction and the urge for comprehensive documentation are obstacles to adopting agile methods beyond the development team. Hence, the results of our study provide useful implications for research and practice by identifying critical problem domains when implementing agile methods at the organizational level.

Keywords
Agile Software Development Methods, Agile Thinking, Exploratory Case Study

1. INTRODUCTION
Agile software development methods and their respective project management methods are a recurring and controversial issue in science and practice. Major benefits include quality improvements because of better teamwork and frequent customer interaction. Furthermore, customer feedback avoids misunderstandings and continuous requirements control, testing and releasing leads to continuous approval of the software by the customer. Many studies have shown that agile methods may reduce project costs and development time by simultaneously enhancing quality (see for example [6, 9, 14, 35]). Nevertheless, there are critical voices, too. Many constraints may be hindering the effectiveness of agile methods [7, 26, 27, 29]. Also, many organizations adopt agile methods, at least partially, without understanding the concept of agility itself [24].

Based on expert interviews with employees of the one software developing and consulting organization, called *SoDeCo* (a pseudonym for the purpose of anonymity), we found that the benefits of agile methods are known but still not used in software development projects at SoDeCo. This situation led to an initial agile project based on Scrum to develop a new e-commerce system for a global company. The use of Scrum was triggered by a few project managers. The experience with this project confirmed the advantages of agile methods. Self-organization was favored by the team and a running prototype was available much earlier as compared to projects using traditional methods. The project members stated that they were able to faster implement new and detailed requirements without losing sight of the overall project goal. Furthermore, the daily Scrum-meetings helped them to better track and predict their progress. Despite of the experienced benefits, the team was not able to convince other project teams to use Scrum and therefore Scrum was not or only partially adopted at SoDeCo.

Interestingly, this turned out to be a phenomenon that is observed quite often as confirmed by Abrahamsson et al. [2] and Ågerfalk et al. [3]. Therefore, questions about the causes for these situations arose. Is a specific organizational culture necessary or is the way of individual and organizational thinking crucial for the use of agile methods? Our assumption is that the ways of thinking (i.e. the attitudes, opinions, knowledge ...) when referring to agility and agile methods are different among several groups within an organization. Potential research needs to include barriers or success factors for the adoption of agile methods at the organizational level. Also, specific needs, dependencies or interactions of organizations, individuals and other departments beyond the development team have to be taken into account [2, 3].

Based on our preliminary findings, the aim of our research is to identify “how agile” the staff of SoDeCo is thinking. Especially, we are going to investigate what characteristics in software development projects lead to a more or less agile way of thinking among project members, project managers and other stakeholders within the organization. Likewise, we want to identify potential obstacles, causing employees or decision makers to show resistance against agile practices and therefore hindering their effective use and further adoption.

To investigate this issue, we conducted an exploratory single case study within SoDeCo to answer the following research questions:

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(Q 1) How agile is the way of thinking of the organization and its individuals?
(Q 2) Are there differences in the way of thinking between several organizational roles and how do they manifest themselves?
(Q 3) What influencing factors may hinder the adoption of agile software development methods and how can they be overcome?

Extensive research on agile methods was conducted in recent years [2, 3]. Systematic summaries of existing studies are given in [14] and [28]. Nevertheless, there is only little research available that examines the specific cultural and organizational factors negatively influencing the adoption of agile software development methods [26]. In addition there are no studies investigating differences in adoption factors between several roles or departments within an organization.

The remainder of this paper is structured as follows. In the second section, we motivate our research by a literature review and deduce the concept of "Agile Thinking". The third section describes our exploratory case study design and in the following fourth section, the results are qualitatively analyzed and interpreted. The paper closes with conclusions and implications in the fifth section. Furthermore, limitations of the study are addressed and an outlook is given.

2. RESEARCH BACKGROUND

In reaction to the inadequateness of traditional software development methods for many projects with regard to time and cost constraints, bureaucracy of documentation and increasing changes in the business environment, new and more flexible development approaches were developed [1]. In fact, "lightweight" thinking is nothing new. Examples for iterative, incremental or evolutionary development practices can be tracked back till the 1970's. Unfortunately, these practices were not considered to be seriously adopted until the late 1990's [23]. The term "agile" referring to software development became well known through the *Agile Manifesto* which was formulated in 2001 by a group of supporters of alternative development approaches [18]. Today, some of the best known agile approaches among others are Scrum, Extreme Programming, Feature Driven Development and the Crystal Family. A summary of these and other approaches can be found in [7], [14], [19] and [24].

The Agile Manifesto states four key values and twelve principles that underlie all agile software development approaches [5, 11]. Due to the lack of an acknowledged definition until today, the four key values may serve as an explanation while stating the basic characteristics of all agile approaches. An overview of various definitions can be found in [1] and [17]. Many of them refer to the Agile Manifesto as well, which therefore represents the basis for this work, too. The key values of the Agile Manifesto are (1) the concentration on individuals and interactions more than on processes and tools, (2) the delivery of working software instead of focusing on comprehensive documentation, (3) regular customer collaboration over contract negotiation and (4) responding to changes instead of purely following plans [5].

However, despite the benefits of agile development approaches, there are limitations as well. Bleek and Wolf [7] provide a number of indicators against the usage of agile software development methods. Among them are cultural aspects, missing customer commitment, mandatory processes or the fear of responsibility [7]. It becomes evident that a lot of constraints may hinder the effective and efficient use of agile development methods. Nevertheless, more and more organizations report having adopted agile approaches [24, 31]. But with an increasing awareness, the confusion about agility, its meaning and the optimal usage of agile approaches is increasing, too. Therefore, many researchers call upon more studies within this field [2, 3, 14, 15, 24].

In order to be able to investigate the agility of an organization, one has to understand the meaning of agility. Although the Agile Manifesto describes agility in terms of software development, the concept of agility is much older. Agility became well known in the business literature around the 1990's [12]. It was mainly utilized in the fields of management, manufacturing and organizational behavior and emerged out of the concepts *flexibility* and *leanness* [12, 17].

Sharifi and Zhang [34] identified four capabilities an organization has to generate to be agile. These are *Responsiveness*, *Competency*, *Flexibility*, and *Speed*. The authors underline that these capabilities ensure appropriate reactions to changes in the environment [34]. The handling of change as a fundamental prerequisite for agility is confirmed by Conboy [12], who named *Creation* of change, *Proaction* in advance of change, *Reaction* to change, and *Learning* from change as components of agility [12].

These general characteristics of agility can be found in the Agile Manifesto [5], too. The handling of change can be seen in the values of customer collaboration (value 3) and response to change (value 4), thereby competency and responsiveness are reflected in the concentration on individuals (value 1) and flexibility and speed lead to the fast delivery of working software (value 2).

Although the Agile Manifesto covers many aspects of agility, the use of agile methods does not automatically lead to an agile organization. As stated by Abrahamsson et al. [2] and Mangalaraj et al. [26] the success of agile software development projects often sticks to the team level. Mostly it is difficult, if not impossible, to implement agile principles beyond single development teams, because of many constraints and dependencies with regard to the rest of the organization [2, 26].

We assume that the causes for this phenomenon are attitudes and ways of thinking of individuals. Given the fact that methods contain not only isolated practices, but are bound together by a set of values and goals lying behind the principles of the method [4, 12], it is reasonable that these values and goals have to be coexistent in people's minds when working with these methods. This necessity becomes particularly evident when looking at agile software development methods. As stated above, the core of the Agile Manifesto consists of four "values" which have to be shared by every user. It has to be assumed that agile methods may only be adopted at an organizational level when the way of thinking of the whole staff of an organization is congruent with agile values. This assumption is supported by the conceptual framework of agility by Sharifi and Zhang [34]. Besides technology and innovation they define *people* and *organization* as main supporting areas of agile capabilities. Furthermore, Sambamurphy et al. [32] distinguish between operational, *customer* and *partnership* agility [32]. While operational agility is directed to processes, partnership and customer agility deal with relationships

to customers and partners [32, 33]. For the latter two it is not sufficient to be agile in one or two projects only. To be fully agile means that software developers and project staff as well as managers, sales and distribution staff, and all other departments have to share the above stated agile values and principles.

Here only those factors are of interests that have an influence on the selection of the development method and on the realization and the success of the project itself. It is obvious that a more or less agile way of thinking in factors critically affecting the named areas may play an important role for adopting agile methods. Therefore, we reviewed the literature for potential success factors in agile software development projects as a starting point for our study. A comprehensive overview of existing empirical studies on agile development can be found in Dybå and Dingsøyr [14]. We also focused on the studies of Chow and Cao [10] and Misra et al. [28], who identified several success factors for the adoption of agile development methods that fit the purpose of our research. Furthermore, we initiated discussions and conducted interviews with software development project experts of SoDeCo to identify additional factors. The whole set of identified factors is called *Influencing factors* in the following. Table 1 lists all influencing factors used. The factors taken from literature are explained in the respective studies [10, 28]. A short explanation of the influencing factors identified through the expert interviews follows:

- Self-responsibility is considered important for adopting agile approaches including personal characteristics like autonomous execution of tasks, initiative and self-organization.
- Distribution of power refers to issues like power to direct a company or organization. It is assumed that a potential loss of power will make people hold back information and therefore threaten the effectiveness of agile approaches.
- Pricing models focuses on the question, if alternative and flexible pricing models for agile approaches are understood by customers and employees.
- Documentation covers the aspect that detailed and comprehensive project documentation may be seen as a quality indicator in some environments and therefore hinders the acceptance of agile approaches.

Table 1. Identified influencing factors

Framework category	Influencing factor	Source
Individual factors	IF1: Self-responsibility	Expert interviews
	IF2: Competencies	[10, 28]
Team factors	IF3: Communication	[10, 28]
	IF4: Decision processes	[10, 28]
	IF5: Team size	[10, 28]
	IF6: Distribution of power	Expert interviews
Environ-mental factors	IF7: Pricing models	Expert interviews
	IF8: Customer satisfaction	[10, 28]
	IF9: Customer collaboration	[10, 28]
	IF10: Documentation	Expert interviews

Furthermore, Mangalaraj et al. [26] developed a framework for the acceptance of software process improvements. According to this framework acceptance depends on individual, team, technology, task, and environmental factors [26]. Along our research aim, the framework gives us additional categories to investigate the influence on the way of thinking.

In the context of our research, we exclude technology and task factors, dealing with technical characteristics and supported task types of the development methods. We rather concentrate on the *individual*, *team* and *environmental* factors that are able to cover Agile Thinking. Individual factors contain personal attitudes, knowledge and abilities; team factors contain the social culture within a development team, high status individuals' opinions and majority opinions and attitudes; and environmental factors consider mainly customers and their influence on the use of development methods [26]. As table 1 shows all identified influencing factors are assigned to the categories of [26].

As illustrated in figure 1, the accumulation of the different influencing factors, the underlying categories in relationship to the agile values and the identification of the principles of agility of individual persons at an organizational and individual level is what we call *"Agile Thinking"*.

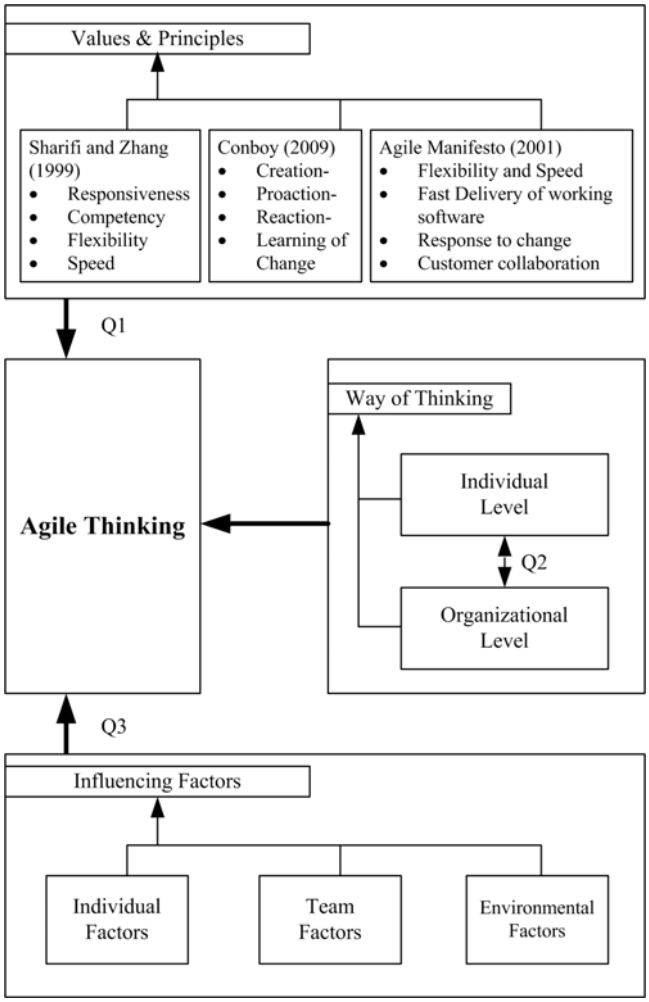

Figure 1. Agile Thinking

Agile Thinking comprises the attitudes and opinions of individuals with regard to agility within their everyday business. It describes the willingness of individuals to act agile – even if this means to change traditional habits and approaches. Ganguly et al. [17] describe an agile enterprise as being able to "adjust to any unexpected or sudden changes in the environment both rapidly and efficiently". Therefore, the attitudes regarding agility of all individuals of an organization strongly affect the agility of the whole enterprise. The idea behind this concept is that individuals covering key positions within an organization may have a great influence in supporting or hindering the adoption of agile methods. The same effect may occur when the majority of the staff of one or more departments demonstrates a more or less agile way of thinking.

3. CASE STUDY DESIGN AND CASE DESCRIPTION

According to Gable [16] and Yin [36] the case study approach is suitable to gain a deep qualitative understanding of problems being investigated [16, 36]. Especially in the rapidly changing field of Information Systems, case studies offer the opportunity to deliver valuable insights into organizational behavior [16]. Furthermore, we intend to identify factors potentially influencing the use and adoption of agile methods. This exploratory character of our research strengthens the applicability of a case study approach, too.

In order to gain a comprehensive overview about and first insights into the phenomenon of Agile Thinking, we chose a single and exploratory case study design. To demarcate the case study, the unit of analysis has to be clearly defined [36]. Therefore, the unit of analysis of our study is the overall software developing and consulting organization (SoDeCo), especially the way of thinking regarding agile methods as demonstrated by individuals and groups within this organization.

Having this in mind we have to make sure to gather appropriate and sufficient data. Although case studies are qualitative research methods, the data collected and analyzed may be both qualitative and quantitative [8, 16, 36]. In fact, combining different types of data to compensate strengths and weaknesses of the single ones is often favored as it provides a fuller picture of the underlying phenomena investigated [8, 20, 21, 36].

To take advantage of the use of qualitative and quantitative data, we decided to use expert interviews and discussions as well as a web-based survey for data collection. Initial ideas for potential factors influencing the way of thinking were gathered qualitatively by conducting interviews with software development and project management experts at SoDeCo. The results were used to develop a set of questions to investigate the way of thinking within the overall organization, including as many departments and functions of SoDeCo as possible. According to Darke et al. [13], time consuming interviews should only be conducted when desired data cannot be obtained in any other way [13]. Because of that, we decided to utilize a web-based questionnaire, which can be considered a useful data collection method within case studies as well [16, 36].

To obtain answers about the way of thinking along the identified influencing factors, we developed a set of statements (items) for every single one of them that represent the characteristics of agile approaches (see appendix). To give an example, one statement for the factor self-responsibility is "Team internal self-organization prevents slack of team members". All statements are formulated in such a way that an agreement implies either an agile or a traditional way of thinking on the part of the respondent. For the example mentioned, an agreement implies the assumption that project members coordinate and execute their tasks independently and consequently avoid slack that could emerge while using inflexible and superior project plans. For assessing the statements we used a five-point-Likert-scale. Respondents had to answer every statement with "agree", "rather agree", "neither/nor", "rather disagree" or "disagree". Additionally, the respondents were given the opportunity to provide further comments to every question in free text forms. Therefore, the results are comparable to those that would have been collected via standardized interviews. To ensure validity and readability, three members of the company and two additional professionals were asked to review the statements and to check their face validity. The feedback was included before starting the study. The invitation to answer the web-based questionnaire was sent to the staff of SoDeCo via an internal email distribution list.

After three weeks, a total of 58 people responded by answering the online questionnaire. After reviewing the raw data and checking the consistency of the 58 responses, 9 had to be excluded, because answering the questionnaire was terminated before completion. Finally, 49 responses were used for further analysis and interpretation. The data collected was then analyzed and interpreted in a qualitative way. To validate and verify the results of the interpretation, we again conducted expert discussions afterwards.

SoDeCo undertakes individual software projects in manufacturing and commerce for large and medium sized companies. The company consists of three divisions and operates in Europe and the US. Mostly, they use traditional software development methods, such as the Waterfall-Model, the V-Model and some customized versions. Nevertheless, some of the staff has experiences with agile software development methods, too. Although the benefits of agile methods were recognized during the initial Scrum-project mentioned in the introduction, the team members found it difficult to convince substantial parts of the rest of the organization to use agile methods in future projects. This problem served as an entry point for our study. We assumed that parts of the organization had attitudes, which hindered the adoption of agile methods. Thus, we intended to further investigate "how agile the organization is thinking". Insights into the characteristics of the organization are provided in table 2.

The majority of respondents to our questionnaire already had experience in software projects, with nearly 80% of them having participated in software projects for more than 12 months (see table 3). As the level of experience of the participants is quite high, we assume the data set to be suited to serve the purpose of our study.

Table 2. Profile of investigated company

Manpower	ca. 180 employees, 3 divisions
Location	Headquarter Germany, 4 locations world wide
Customers	Large and medium sized enterprises world wide
Used traditional methods	Waterfall, V-Model (main part of projects)
Used agile methods	Scrum (single project); Scrum-like fragments in mixed methods (some projects)
Company background	Specialized in individual software development. Planning, implementation and maintenance of developed software. Specialized in IT consulting for semi conductor and energy markets.

Table 3. Experience in software development projects

Item	Value	Number of respondents	Percentage (%)
Experience in software projects	Yes	42	85,7
	No	7	14,9
Duration of participation in software projects	< 12 months	3	6,1
	12-60 months	17	34,7
	60-120 months	11	22,4
	>120 months	11	22,4

4. DATA ANALYSIS AND RESULTS

First, the respondents had to clarify their level of experience with project management and software development methods we listed in the questionnaire. It contained eleven agile methods and ten traditional methods. The results show that the traditional methods are more likely to be known and used than the agile ones. Surprisingly, only very few respondents consider themselves as professionals (5% for agile methods; 8% for traditional methods), although the study took place in a software developing organization. In detail, at least one traditional and agile method is known by all but one. Furthermore, about 70% have used at least one traditional method and about 56% experienced at least one agile method.

Second, related to Q2 we divided the data set for further qualitative analysis into two independent subgroups:

- *decision makers*, including board members, managers and group leaders and
- *employees*, including software developers, consultants and others.

Third, all statements were grouped according to the identified influencing factors (see table 1). The analysis of every statement included the calculation of mean values and standard deviations and a qualitative interpretation of them. Thereby the mean value represents the average attitude throughout the analyzed groups and the standard deviation is an indicator for the concentration of this attitude. A mean value of 3 shows, that the considered group is indifferent as to agile or traditional thinking, whereas mean values of 4 to 5 reveal Agile Thinking and mean values of 1 to 2 represent traditional thinking. A small standard deviation supports this result, whereas a high standard deviation reveals that the group is either divided into different fractions or that the attitudes are equally distributed among the respondents. In addition, we examined the distribution of the answers for every statement. For example, a skewed distribution is an indicator for tendencies. After the preparation of the data set, the qualitative interpretation of the results was done independently by the authors. All disagreements in interpretation and misunderstandings about the data set were solved in several discussions.

A summary of the results is given in figure 2. It shows the mean values per influencing factor and represents the way of thinking related to decision makers and employees. Surprisingly, a comparison of the two subgroups revealed no or only minor differences between decision makers and employees. However, the distribution of the ways of thinking over the influencing factors is varying.

Interestingly, IF6 is the only factor, where a small difference between employees and decision makers is noticeable. Looking at the single items, it seems that employees fear a loss of power after sharing implicit information more than decision makers do. This might be due to the fact that decision makers think more in terms of the overall organization than employees do. However employees' reluctance to share knowledge because of a fear to lose power may severely threaten agile projects – probably more than decision makers' lacking willingness would do.

The only factor revealing a clear agile attitude is IF3 (Communication). This shows that decision makers as well as employees prefer non bureaucratic and flexible communication processes and hence share an Agile Thinking regarding this issue. Furthermore, the respondents of both subgroups show a tendency towards agile over traditional thinking related to the different influencing factors. Therefore we examined the single statements for every factor to gain further insights. This was done by the following procedure:

Every statement was either classified agile, traditional or neutral according to its mean value for the total sample as well as for the two subgroups. Afterwards, we counted the classified statements and calculated the percentages per factor. Additionally, the percentages of respondents were calculated according to agile, traditional or neutral answers. Table 4 summarizes the results of this procedure, structured into two columns based on the percentage of statements and the percentage of respondents per factor. Furthermore, the results for the two subgroups are shown accordingly. As a result, every cell delivers insights into the way of thinking. Noticeable deviations are subsequently qualitatively analyzed in detail and interpreted.

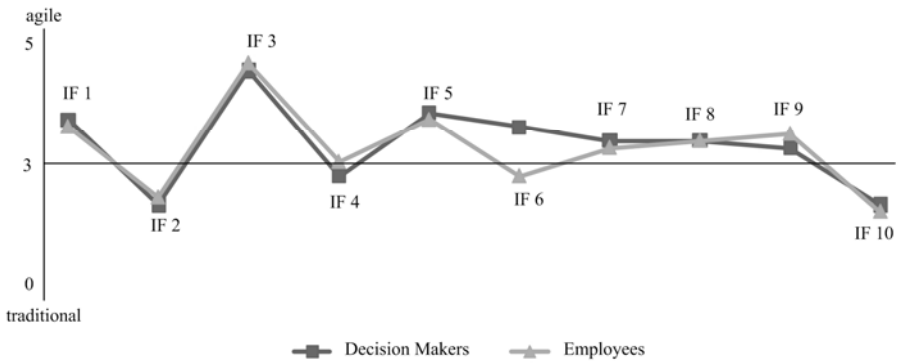

Figure 2. Mean values per influencing factor of the whole sample

Similar to figure 2, the results in table 4 hardly differ between decision makers and employees. Minor differences between the two subgroups are noticeable with influencing factors 2 (Competencies), 5 (Team size), 6 (Distribution of power), 8 (Customer satisfaction), and 9 (Customer collaboration). The differences mainly result from a higher number of neutral thinking respondents in the employee group. With none of the statements a substantial difference between agile thinking in one subgroup and traditional thinking in the other is ascertainable. Despite this observation, interesting results can be derived by investigating the content of the single statements where differences were observed.

There were two influencing factors showing a total agile way of thinking along all statements. These were IF3 (Communication) and IF5 (Team size). Respondents state that regular and intensive communication between team members improves quality and that smaller teams are more effective and flexible with respect to changes under time and cost constraints. Looking at the percentages of the respondents, employees seem to be more indifferent regarding team size (IF5) as opposed to decision makers. This could be an indicator that the actual number of team members is less important as long as communication processes are flexible. Closely connected to this issue is IF2 (Competencies). It addresses the question, whether team members should be generalists or specialists in order to deliver high quality under time and cost constraints. Although decision makers seem to support specialists, a concentration on the neutrally answered statements on employee side can be observed. This means that the respondents prefer neither of the two alternatives, but they state that a software developing team should always contain specialists and generalists to be successful. The number of neutral answers by all respondents supports this issue. This does not hinder the adoption of agile approaches directly, but it indicates a slight tendency to combine agile and traditional approaches.

Differentiated results have to be emphasized for the influencing factor IF1 (Self-responsibility). Most of the statements belonging to this factor suggest an agile way of thinking. They deal with the issues quality, self-organization, motivation and flat hierarchies. In contrast, three statements showed a different way of thinking. It is striking that all of these addressed leadership issues. Respondents showed a tendency to traditional thinking while stating that a successful project needs leadership by superiors, the project management should be supervisory to the project team and important decisions have to be confirmed by management. This leads to the conclusion that the respondents know that characteristics of agile approaches will increase quality and motivation, but they still urge for someone superior, who will be responsible for the project's success or failure. This clearly is an obstacle to adopting agile approaches and is supported by the answers to IF4 (Decision Processes). Here, the respondents are very indifferent – showing an agile way of thinking referring to fast and non bureaucratic decisions on the one hand and asking for confirmation by management on the other hand.

Influencing factors mainly considering customer issues do not deliver a clear picture. The statements of IF8 (Customer satisfaction) and IF9 (Customer collaboration) reveal either very controversial answers or a concentration on the neutral position, although a slight tendency to an agile way of thinking can be observed. In contrast, single statements dealing with cost-related aspects reveal a more traditional way of thinking by decision makers. Furthermore, there are differing opinions on the statements about additional or changing requirements. Some state that changing requirements lead to rising costs and diminish the quality of the products. This fact is clearly hindering the adoption of agile approaches, because changing requirements are one of their key principles. IF10 (Documentation) appears to be a potential customer-related obstacle, too. Nearly all respondents show a traditional or neutral way of thinking, stating that comprehensive documentation is required to prove quality and professionalism. Additionally, IF6 (Distribution of power) may support the assumption of customer-related problems. When people withhold information due to the fear of losing bargaining power, the effective adoption of agile methods is critical.

The problems identified above that are caused by cost-related issues are confirmed by IF7 (Pricing models). There is an agile attitude regarding a preference for flexible pricing mechanisms to improve the quality, because of more flexibility with features. But despite this, there are again very controversial answers for statements dealing with the ability to keep control over costs with flexible pricing mechanisms and addressing whether customers will accept such mechanisms. Similar to IF6, an explanation for this behavior could be the aspiration for pricing sovereignty by the software developer and this again hinders the adoption of agile methods at an organizational level.

Table 4. Way of thinking by statements and respondents per influencing factor

Framework Category	Influencing factor (IF)		Way of thinking (in % of statements per factor)			Way of thinking (in % of respondents per factor)		
			Total	Decision makers	Emplo-yees	Total	Decision makers	Emplo-yees
Individual factors	IF1: Self-responsibility	Agile	67,00	67,00	67,00	61,22	66,00	60,00
		Traditional	11,50	11,50	11,50	18,37	16,00	18,97
		Neutral	11,50	11,50	11,50	20,41	18,00	21,03
	IF2: Compe-tencies	Agile	0,00	0,00	0,00	20,41	15,00	21,79
		Traditional	33,33	83,33	33,33	44,22	46,67	43,59
		Neutral	66,67	16,67	66,67	35,37	38,33	34,62
Team factors	IF3: Communi-cation	Agile	100,00	100,00	100,00	89,80	90,00	89,74
		Traditional	0,00	0,00	0,00	2,04	5,00	1,28
		Neutral	0,00	0,00	0,00	8,16	5,00	8,97
	IF4: Decision processes	Agile	50,00	50,00	50,00	40,82	35,00	42,31
		Traditional	50,00	50,00	50,00	39,80	40,00	39,74
		Neutral	0,00	0,00	0,00	19,39	25,00	17,95
	IF5: Team size	Agile	100,00	100,00	100,00	59,18	66,67	57,26
		Traditional	0,00	0,00	0,00	10,88	13,33	10,26
		Neutral	0,00	0,00	0,00	29,93	20,00	32,48
	IF6: Distribution of power	Agile	50,00	0,00	50,00	35,71	50,00	32,05
		Traditional	50,00	50,00	50,00	33,67	20,00	37,18
		Neutral	0,00	50,00	0,00	30,61	30,00	30,77
Environmental factors	IF7: Pricing Models	Agile	50,00	50,00	50,00	41,84	47,50	40,38
		Traditional	0,00	0,00	0,00	21,94	17,50	23,08
		Neutral	50,00	50,00	50,00	36,22	35,00	36,54
	IF8: Customer satisfaction	Agile	25,00	50,00	25,00	55,10	60,00	53,85
		Traditional	0,00	25,00	0,00	24,49	25,00	24,36
		Neutral	75,00	25,00	75,00	20,41	15,00	21,79
	IF9: Customer collaboration	Agile	33,33	33,33	33,33	57,48	48,33	59,83
		Traditional	0,00	16,67	0,00	23,81	26,67	23,08
		Neutral	66,67	50,00	66,67	18,71	25,00	17,09
	IF10: Documen-tation	Agile	0,00	0,00	0,00	13,27	20,00	11,54
		Traditional	50,00	50,00	50,00	53,06	55,00	52,56
		Neutral	50,00	50,00	50,00	33,67	25,00	35,90

5. CONCLUSIONS AND OUTLOOK

We conducted an exploratory case study in a medium-sized software developing and consulting company. The aim was to identify, how agile this company is thinking with regard to project management in software development projects. Therefore, we asked two independent groups of respondents – decision makers and employees – about their experience with different project management and software development methods. We additionally concentrated on their perceptions along ten influencing factors in order to gain a deeper understanding of their way of thinking.

The case study provided first insights into the concept of Agile Thinking according to the investigated influencing factors. Referring to Q1, we could ascertain that the company has a tendency to agile thinking. Despite of this, there exist several obstacles hindering the implementation and adoption of agile approaches. Furthermore, we have to revise our assumption of

different attitudes between decision makers and employees as a possible reason. With respect to Q2, we detected only minor differences in the way of thinking between different organizational roles. A slight tendency towards a more traditional way of thinking is recognizable for decision makers, but mainly resulting from a large number of employees with a neutral attitude.

According to Q3, we identified the following factors and problem domains, hindering the adoption of agile approaches at an organizational level.

(1) Mainly, cost-related aspects track attention. Most statements which are answered in a traditional, neutral or controversial way of thinking, focused on cost aspects. Related issues are the loss of cost control, no acceptance of flexible pricing models and problems in assessing the cost-related consequences of agile methods.
(2) Another aspect is a clear demand for superiors taking responsibility for the project's results. Decisions have to be confirmed by management. This indicates that a leadership position within projects is appreciated.
(3) Customer satisfaction and collaboration are problem domains, too. Despite the awareness that customer interaction improves the quality, there is a kind of fear of losing bargaining power. Furthermore, there were very contradictory answers in this field. This shows uncertainty about the optimal degree of customer interaction.
(4) A comprehensive documentation is still seen as a quality indicator for customers. Thus, there is the risk that agile methods may be seen as insufficient, only because of their reduced documentation.

Summarizing the results, it is obvious that there are certain potential obstacles, hindering the adoption of agile methods, although they are not different when comparing decision makers with employees. Our results offer insights into problem domains, which have to be addressed explicitly, while implementing agile methods within an agile-inexperienced company. These results have several implications for research, SoDeCo and similar companies. Given the three categories of influencing factors (see figure 1), none of them has a totally hindering or supporting influence on Agile Thinking. Table 5 summarizes the most critical aspects, where Agile Thinking was mainly missing.

Table 5. Gaps in Agile Thinking

Individual factors	• Lack of self-responsibility • Demand for leadership
Team factors	
Environmental Factors	• Cost-related aspects • Fear of sharing knowledge • Fear of losing bargaining power • Comprehensive documentation as quality indicator

The best agile attitudes were found among the Team factors. The factors Communication and Team size showed clear agile ways of thinking, whereas Decision processes and Distribution of power resulted in many neutral answers. The latter two are closely connected to the Individual factors, where the lack of self-responsibility and a demand for leadership were obvious obstacles to agile methods. The most hindering issues were revealed with the Environmental factors. Although the agile principle of customer collaboration and the creation and response to change are known, they are often seen as annoying and uncontrollable. Also, the fear of losing power, because of too knowledgeable customers is an obstacle within the Environmental factors.

As a result, our research reveals the influencing factors, where an agile way of thinking is probably already in place when intending to make use of the advantages of agile methods within a more traditional project organization. These factors, for example Communication (IF3) and Team size (IF5), are especially suitable to start implementing agile approaches, tools or process components, because there will be no resistance among decision makers and employees. The other way round, our results show where traditional ways of thinking are still predominant and how they manifest themselves. Therefore, it is possible to explicitly foster attempts to change these organizational aspects in terms of enabling agile methods.

Hence, future research should focus on approaches to avoid the identified obstacles in the different categories. Some studies are already partially addressing these issues, mainly by investigating the combination of agile and traditional methods, but the results are very different. Karlström and Runeson [22] for example find that Extreme Programming as an agile approach can work well within stage-gate oriented organizations [22]. However, very formalized and bureaucratic organizational cultures hinder the effective execution of agile approaches [25, 30] as confirmed by our study, too. The given obstacles may serve as a starting point to investigate the combination of agile and traditional approaches at an organizational level.

Additionally, a further investigation of the introduced concept of Agile Thinking offers the possibility to gain an insight into an organization. This insight may then serve as an instrument to prove the ability of a company to act and think agile. Further aspects of future research could be to develop methodologies to change the way of thinking towards agile for the identified problem domains. A suitable instrument could be the systems dynamics approach. Another interesting aspect is to investigate the way of thinking of customers and compare the results with ours.

Our survey suffers from some limitations that should be addressed in later studies. Due to its exploratory and qualitative character, our case study was limited to one company as a starting point. Its tentative results require additional substantiation on the basis of a multiple case study design. Based on larger samples testable propositions may be derived in the long run.

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Appendix

Appendix 1. Statements (items) per influencing factor

Influencing factor	Statements (items)
IF1: Self-responsibility	• Ein erfolgreiches Projektteam benötigt Führung durch Vorgesetzte. • Das Projektmanagement ist dem Projektteam übergeordnet. • Eigenverantwortung der Projektmitarbeiter erhöht die Qualität des Produktes • Eine selbständige Organisation der Projektteams erhöht die Motivation der Mitarbeiter • Teaminterne Selbstorganisation verhindert Leerlaufzeiten der Mitarbeiter.
IF2: Competencies	• Ein Softwareprojekt ist nur erfolgreich, wenn das Team sowohl aus Generalisten als auch Spezialisten besteht. • Einzelne Mitarbeiter sollten entsprechend ihrer Kompetenzen eingesetzt werden. • Generalisten sind Spezialisten vorzuziehen. • Die Entscheidungskompetenzen sollten bei einer Person liegen. • Ein Team von Generalisten ist flexibler. • Durch viele Spezialisten entstehen häufig Leerlaufzeiten der Projektmitarbeiter.
IF3: Communi-cation	• Regelmäßiger Austausch zwischen den Projektmitarbeitern erhöht die Qualität des Projektergebnisses. • Die Kommunikation zwischen den Projektmitarbeitern wird durch komplexe Hierarchien behindert.
IF4: Decision processes	• Wichtige Entscheidungen müssen formal von der Projekt-/Unternehmensleitung bestätigt werden. • Eine flache Projekthierarchie führt zu schnelleren Entscheidungen.
IF5: Team size	• Große Projektteams erzeugen höhere Kosten. • Kleinere Projektteams arbeiten effizienter.
IF6: Distribution of power	• Mitarbeiter neigen dazu, Informationen bei drohendem Machtverlust zurück zu halten. • Die Preisgabe impliziten Wissens führt zu Machtverlust bei einzelnen Mitarbeitern.
IF7: Pricing Models	• Festpreise sind flexiblen Preisbildungen vorzuziehen. • Zusätzliche Kundenwünsche sollten nur realisiert werden, wenn der vereinbarte Preis eingehalten werden kann. • Flexible Preisbildungen werden vom Kunden nicht akzeptiert. • Flexible Preisbildungen erhöhen die Qualität.
IF8: Customer satisfaction	• Die Kundenzufriedenheit ist von der Einhaltung der Kosten abhängig. • Kunden können die Qualität der Ergebnisse nur ungenügend einschätzen. • Kundenzufriedenheit erhöht sich durch regelmäßige Zusammenarbeit während der Projektlaufzeit. • Kunden akzeptieren eine erhöhte Projektdauer bei höherer Qualität. • Bei Zeitproblemen empfiehlt es sich, zusätzliche Mitarbeiter hinzuzuziehen.
IF9: Customer collaboration	• Viele Anforderungen des Kunden sind überflüssig. • Der Kunde muss sich zu Beginn des Projektes über die Anforderungen im Klaren sein. • Der Projekterfolg hängt maßgeblich von der Kooperation des Kunden ab. • Der Kunde ist in der Verantwortung, Teilergebnisse zu beurteilen. • Nachträgliche Änderungen des Kunden beeinträchtigen die Qualität. • Der Kunde ist nicht in der Lage, den Projektfortschritt zu beurteilen.
IF10: Documen-tation	• Der Kunde assoziiert ausführliche Dokumentation des Projektverlaufs und der Projektergebnisse mit Professionalität. • Der Kunde erwartet umfangreiche Dokumente zu Projekt(teil)ergebnissen.