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Research of the Use of Agile Methodologies in the Czech Republic

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Abstract. Agile methodologies have recently been widely gaining ground worldwide. We assumed another situation in the Czech Republic. In 2005 only few researches about the use of agile methodologies have been presented, which have not been evidently focused on the Czech environment. Therefore we decided to conduct our own survey. The research objective was to determine the rate of agile approaches usage and practical experience with these approaches in companies in the Czech Republic. This paper presents the results of that research.

1 Introduction

Agile software development evolved in the mid 1990s when some "light-weight methodologies" were defined and used as a part of the reaction against "heavyweight" methodologies. Since 2001, when the Agile Manifesto was created, these methodologies, such as Extreme Programming, Feature-driven Development, Scrum, Crystal, Dynamic Systems Development Method, and others were denoted as agile. Agile software development is an iterative process that allows small development teams to build software functionality in a collaborative environment that is responsive to business change. Development is done in short iterations (typically weeks to months) ending with working increment of software.

Advantages of the agile software development include faster time to market, lower development costs and better quality. Agile methodologies on the other hand does not suite to all projects. According to agile evangelists, books and case studies agile methodologies are more suitable when requirements are emergent and rapidly changing, the corporate culture supports negotiation, people are competent, skilled and trusted and projects are implemented by small teams with fewer than 20 to 40

people. Other limitations of agile software development according to (Tur, France, Rumpe 2002) are: limited support for distributed development environment, subcontracting, building reusable artefacts, developing safety-critical, large and complex software.

Since 2004 we have been seeing the much broader adoption of agile practices worldwide. We assumed another situation in the Czech Republic. Our previous research made in 2002 exposed that the use of software development methodologies in our country is high below the world's level. We defined some research questions. First, we wanted to know, whether the situation with low level of formal methodologies usage had changed with expansion of agile approaches. Second, when we decided to conduct our survey in 2005, only few researches about the use of agile methodologies have been presented, which have not been evidently focused on the Czech environment. Third, we wanted to examine the extent of knowledge of agile methodologies in the software sector. Since that time I presented principles of agile methodologies first at the Objects 2002 Conference in Prague (Buchalcevova 2002), agile topics have been appeared more often in the programs of software conferences in the Czech Republic. Next to many English books Czech original books about agile methodologies have started to appear (Buchalcevova 2005), (Kadlec 2004). But we did not have the feedback from practical software development. Therefore we decided to conduct our own survey. The survey was based on these assumptions:

- A substantial part of IT professional community has the low level of knowledge of software development methodologies
- A substantial part of IT companies in the Czech Republic does not implement any formal methodology
- Agile methodologies are used by small companies and small teams

This paper presents the results of the survey that was carried out in 2006 as part of the dissertation (Leitl 2006).

2 Research Characteristics

The research objective was to determine the rate of agile approaches usage and practical experience with these approaches in companies in the Czech Republic. The aim was to carry out the research for a wide spectrum of companies involved in the software development.

2.1 Questionnaire

The research was carried out over a period of about six months, from December 2005 to April 2006 and was based on a survey. We prepared a questionnaire consisted of 18 questions, each one consisted of:

- The exact wording of the question and possible answers
- The reason why this question was included in the questionnaire
- Information how the answer would influence the overall agility index (see 3.1) and its calculation.

As we assumed a limited awareness of methodologies in general, and that of agile methodologies specifically, the questionnaire was supplemented with a presentation of agile principles and the questions were formulated in such a way that they would be comprehensible to respondents with low level of knowledge of methodologies. The questionnaire was thus not only a part of the research but it also provided some basic information about agile methodologies and contributed to their publicity. The respondents were contacted by the direct mailing and then they were offered a personal appointment to fill out the questionnaire. They could choose to have the company data processed anonymously. The whole questionnaire contained about 15 pages, therefore I present only its abbreviated form in the appendix to this paper.

2.2 The Structure of the Sample

50 companies involved in software development were chosen from the database of companies maintained by the Czech Society for System Integration (CSSI) and from the "Top 100 companies in the Czech Republic". These companies were addressed by e-mail or were personally visited. Although the response rate was relatively high – 42%, the final sample was only 21 companies.

The respondents represented companies of all size, small development companies with 4–15 employees (10 companies), middle-sized companies with 16–70 software developers (4 companies), and big companies with more than 70 developers (7 companies). 17 companies had the software development as their main activity, out of which 9 companies focused primarily on custom-made software development, 4 companies specialized in commercial off-the-shelf solutions and 4 companies developed solutions primarily for their own needs.

3 Research Results

3.1 The Rate of Agile Methodologies Use

In order to be able to compare the rate, in which agile methodologies or practices were used in individual companies, we have defined an indicator called the "total agility index". This indicator has evaluated software development in a complex manner according to the significance given to all fundamental principles of the agile development. We have defined the algorithm for calculation which is based on answers to questions 1, 2, 4, 5, and 6. In the appendix to this paper, where the survey instrument is presented, you can see impact on agility index calculation for each question, e.g. number of points according to each offered answer. These values are then counted up and in this way we get the "total value of agility", which ranges from 19,2 (no agile approach) to 148,2 (maximum agility). Due to the greater clarity we present the agility index in a percentage form, 0 % stands for non-agility development and 100 % represents totally agile development (see Fig. 1). Most respondents scored between 48 and 62 %, which means balanced compromise between agile and traditional development with moderate dominance of agile

features. Calculating the agility index for a certain company enables to draw a general conclusion about whether the company uses agile approaches and whether it is more or less agile in comparison to other companies.

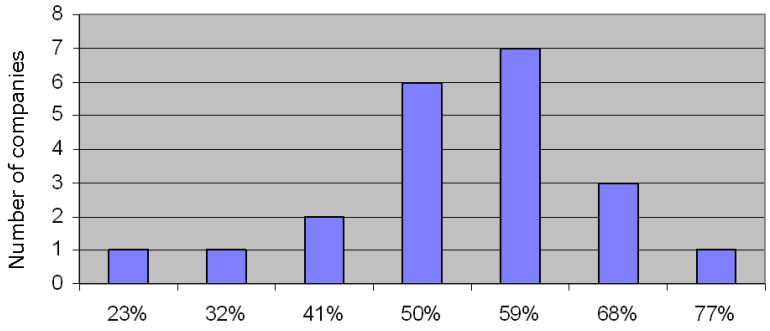

Fig. 1. The agility index for companies in the sample

3.2 Methodologies Used in Software Development

The research objective was to find out what specific methodologies, traditional but particularly agile, had been used in software development companies. Figure 2 shows the results.

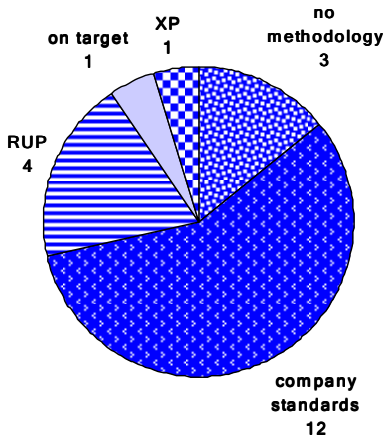

Fig. 2. Use of methodologies

The research has confirmed the assumption that most Czech companies do not use any public methodology. 3 of 21respondents stated that they do not use any methodology, and these were not just small companies. 12 of 21 companies use company standards. As for agile methodologies, Extreme programming (XP) was used in 1 company.

The questionnaire included the question whether the company is considering any alteration to its existing methodology or introducing a methodology if it has not yet used any. Only in two cases did the respondents say that they were considering such an alteration. To sum up, companies (at least those included in the investigated sample) can hardly be expected to adopt more agile approaches.

3.3 Level of Knowledge of Agile Methodologies

The research was based on the assumption that the level of knowledge of methodologies in general and of agile methodologies specifically, is relatively limited. This assumption was confirmed (see Fig. 3). 5 respondents stated they had a basic knowledge of agile methodologies, 8 respondents stated the low level of knowledge, 4 respondents considered their knowledge advanced and the same number admitted this is the first time they have heard about agile methodologies. Given the fact that the respondents were carefully chosen and they had either university degree in informatics or working experience in this field, the result is rather unsatisfactory.

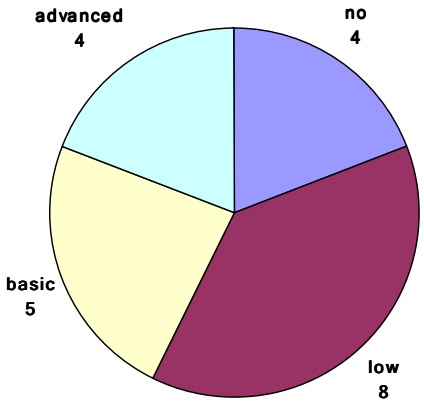

Fig. 3. Level of knowledge of agile methodologies

3.4 Agile Methodologies Strengths

Generally, the respondents with a lower level of knowledge of agile methodologies stated as most important advantages rapid development, good feedback, cost reduction and flexible change processing. On the other hand, respondents with better knowledge of agile methodologies stressed customer involvement and reduced error rate, which they considered more important than quantitative characteristics like cost reduction and faster time-to market.

3.5 The Reasons for Reluctance to the Transition to Agile Concept

First we investigated the general risks associated with an implementation of a new methodology or replacing current methodology (see question 13). By far the greatest risk, that was stated, is that the new mental approach might not be accepted by all employees. People often tend towards stereotypes and accept new methods reluctantly and with certain self-denial. Another risk that was perceived as significant was the fear of the customer outflow after application of a new methodology. On the other hand, the risk of high costs connected with the transition to a new methodology was perceived as rather low. This risk could be relatively easily prevented by creating substantial monetary reserves and by a thorough planning of the transition.

Then we investigated the risks associated with an implementation of an agile methodology (see question 14). The respondents could check off multiple offered reasons (risks) leading to the rejection of the more agile concept of development or directly to rejection of the agile methodology implementation. They could also add additional risks they considered serious in that case. Figure 4 indicates both the general reception of risks by all respondents, as well as the differences between more agile and more traditional companies (according to agility index). The respondents were given the opportunity to check off multiple offered reasons and therefore, the degree of risk was evaluated as the proportion of the number of answers with the specific risk marked to the total number of respondents responding in the given category.

The four most important reasons are:

- Legal reasons – i.e. the risk of financial loss resulting from the lower level of legal protection of all contracts with clients
- The risk that current customers might reject more agile approaches
- Low stress on design and documentation – i.e. the companies fear that they will not be able to develop effectively without having carried out a detailed analysis and design
- Lower applicability for big and complex projects

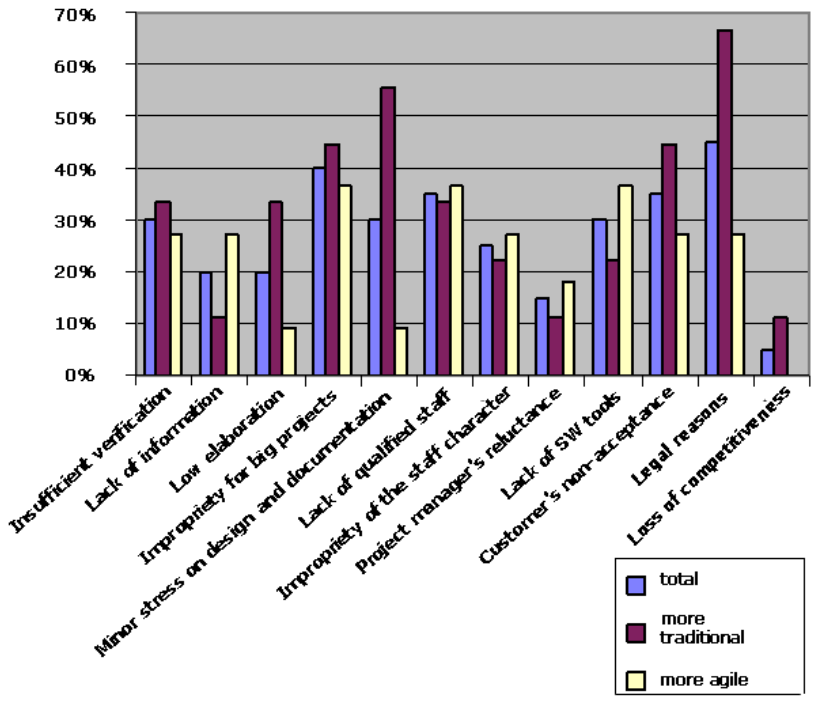

Fig. 4. Risks of agile software development

The results show a substantial difference in the perception of some risks between more agile and more traditional companies. The most perceptible difference is for "Minor stress on design and documentation", "Legal reasons", and "Insufficient verification". These are generally promoted drawbacks of agile development that are perceived especially by more traditional companies that do not have enough knowledge and practical experience with agile methodologies.

A little strange result is presented for issues such "Lack of information", "Lack of qualified staff", "Impropriety of the staff character", "Project manager's reluctance", and "Lack of SW tools", where the companies that are more agile are reporting greater objections than the companies that are more traditional. We can explain it in such a way that companies that have used some agile practises perceive more strongly the lack of qualified staff with necessary character features and the lack of software tools. When the survey was conducted, there was only limited software tools support for agile development. Nowadays the situation is much better, some software tools such an agile development lifecycle management platform called V1: Agile Enterprise from VersionOne or Microsoft's new MSF integrated with Visual studio have started to appear.

4 The Analysis of the Restrictions of Moving to Agile

We analyzed respondent answers in detail to deduce the principal restrictions that prevent the wide use of agile approaches. For greater lucidity we structured these restrictions into four categories:

- Restrictions influencing the developers
- Restrictions influencing the project managers
- Restrictions influencing other roles
- Other restrictions operating not inside the company but rather externally influencing all software developing companies

In the first category the main restriction is represented by the unwillingness or incapability of programmers to extent their activities in software development instead of just writing only source code. Agile development requires developers with wide skills from the ability to deal with customers, to detail analysis, design, implementation and testing. There are two main paths to overcome this restriction. In the first order, it is the responsibility of universities to educate widely skilled developers. They have to take it into account when building their computing curricula. Also companies have their own responsibility of permanent staff education. Second path consist in systematic approach to staff self education and knowledge sharing, which can be achieved e.g. through patterns application, pair programming, team code revisions, and especially knowledge base building and using.

As for the "project managers influencing restrictions" we can name the fear of negative consequences of the simplification and speed-up of the analysis and design stage, again insufficient qualification and not corresponding character of developers. Minor stress on design is generally presented drawback of the agile development that is perceived especially by traditionalists and is often misinterpreted. The agile development does not mean uncontrolled development but highly disciplined process. Agile is based on permanent design and code quality improving instead of big design up front. Some methodologies, such Feature-driven Development, have placed design phase producing overall domain model in the beginning of development lifecycle.

Into the category "Restrictions influencing other roles" we can include maybe the most important restriction of agile methodologies use – e.g. the risk of agile approach rejection on the customer side. This risk presents real barrier against agile approaches adoption, which is perceived worldwide. We can argue against it that the most agile projects, even the greatest one – e.g. project Eclipse, are realized in the field of the open source development and the commercial off-the-shelf solutions. In the field of the custom-made software development we must carry out systematic work on the customer side to improve customer maturity in the sense of customer knowledge of agile methodologies and their advantages, realizing of the necessity of customers involvement in software development and their co-responsibility for project success. That is also the university activity, the target of which must be to produce business people well qualified in cooperation with software developers.

Other restrictions in this category are e.g. the fear of the loss of the competitiveness after the replacement of development methodology, which is often

perceived by the employees responsible for business matters, and the risk of the lower level of the legal protection of the relationships with customers. The “loss of competitiveness” risk was stated only by more traditional companies (see Fig. 4) and we deduce that these respondents have hardly any knowledge of agile principles, as the aim of agile approaches is to support the change during the development process and in this way to contribute to keep or to increase the competitive level. As to legal restrictions, legal issues might to be a permanent problem in IS/ICT. Law is always delayed comparing to technology, this is true especially for countries like the Czech Republic, where information technology progress was blocked for a long time. ICT sector must drive change in legislation to support technology and methodology changes.

We can state the low level of knowledge of formal methodologies generally, and agile methodologies especially as restrictions externally influencing all software development field in the Czech Republic. I think one of the reasons of that fact is the language. Czech Republic is a non native English speaking country, where knowledge of the English language especially in the older part of the population is not very good. Most methodologies originate from English environment, books about methodologies are mostly written in English, many agile conferences take part in USA and for Czech companies and universities it is difficult to travel there. As like as with the restriction of low skilled developers there is also the responsibility of universities to include special courses about software development methodologies into their computing curricula and that of companies to carry on the permanent staff education. If we want to increase the level of knowledge of agile methodologies that was indicated in our survey, students should have to be taught agile approaches to software development. I personally think that it is worth to teach traditional approaches first and then to introduce agile approaches.

5 The Comparisons with Other Studies

As I have mentioned before, when we decided to conduct our survey in 2005, only few researches about the use of agile methodologies have been presented. Almost at the same time Agile Alliance and VersionOne performed the survey focused on using agile methodologies. Results of that survey presented at the Agile 2006 Conference show that agile methodologies are on a world-wide scale gaining ground. Based on about 1,000 responses from people in small to large corporations 75% of the companies surveyed deploy agile processes (Larsen 2006).

Scott Ambler has also performed an Agile Adoption Rate Survey in March 2006 and presented his early findings at Agile 2006 Conference and then complete results in the paper (Ambler 2006). He repeated the same survey in March 2007. Ambler’s survey was sent out to the combined mailing lists from Dr. Dobb's Journal and Software Development and reached a large number of people (4232). Ambler summarizes survey results as “Agile Works in Practice. Agile software development methods and techniques are gaining acceptance within the IT industry. Adoption of agile techniques (65 percent) is further ahead than adoption of agile methods (41 percent), but that should come as no surprise—most organizations choose to perform

software process improvement on an incremental basis." (Ambler 2006) The most popular agile methodologies are XP and Scrum, but other methodologies such as the Agile MSF, Agile Unified Process, and in particular FDD had strong showings. These survey results seem to be very optimistic, but we must realize that the links to that survey are provided by a number of agile sources, thus the survey would tend to reach only those that are either using agile or have knowledge of agile methods.

6 Conclusion

The research results show that one can see quite often some agile approaches in Czech companies. On the other hand, from the evaluation of the level of knowledge of agile methodologies it is obvious that agile approaches are often applied unconsciously.

To sum up the results of our survey and consecutive analysis we can conclude that the use of agile methodologies and approaches in the Czech Republic is only at the starting line and much more development projects could work in a more agile manner. On the other hand this late-movement to agile could bring some advantages. Agile methodologies have matured recently, and have been scaling along a number of dimensions: geographic distribution and global development, number of collaborations with suppliers, combined hardware/software projects including and beyond embedded software, team size, project size, mission criticality, and involvement with legacy systems. These scaling attempts are very important and influence the wide use of agile methodologies.

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Appendix – The Survey Instrument

The questionnaire consisted of 18 questions that are here presented in an abbreviated form. Offered answers are here listed only if they have impact on the agility index.

1. Order the four parameters of a software development project below according to their priority and to how important you think it is to observe them. Please start with the most important parameter.
   - Time
   - Quality
   - Cost
   - Project scope.

   *Impact on the agility index***:** Total of values according to Table 1.

Table 1. Values for the agility index calculation

parameters order	**1**	**2**	**3**	**4**
Time	3	2	1	0
Cost	3	2	1	0
Scope	0	1	2	3
Quality	0	0	1	0

2. How do you deal with requirements changes?
   a. Changes are rejected *(0 points*)
   b. Changes are under the change management (*1 point*)
   c. Small changes are implemented, bigger changes are under the change management (*4 points*)
   d. We have only coarse grained requirements initially, further changes are accepted (*6 points*)

   Impact on the agility index: Number of points for a certain answer in brackets

3. Do you use any software development methodology? (one of listed answers)

   Impact on the agility index: No impact

4. Do you adapt your methodology to individual projects (e.g. according to the project scope or criticality)? (multiple answers allowed)
   a. No adaptation. *(0 points)*
   b. We do not adapt it because our projects have similar character *(1 point)*
   c. We scale our manner of work for great projects to more formality *(2 points)*
   d. We make our manner of work for small projects more flexible *(1 point)*
   e. We adapt our manner of work according to the particular client *(2 points)*
   f. Our methodology itself provides adaptation. *(2 points)*

   Impact on the agility index: Total of points for certain answer (max 3 points)

5. What principles are considered crucial in your methodology? If you are not using any specific methodology what do you personally consider crucial? To each question you can attach from 1 point (not included) to 7 points (CSF for the methodology)
   a. Sequence of development phases (analysis → design → implementation → deployment → maintenance) *(indicator weight = 1)*
   b. Big design up front *(indicator weight = 1)*

c. Sophisticated change management *(indicator weight = 0,3)*
d. Sophisticated requirements management *(indicator weight = 0,8)*
e. Frequent delivery of functional software versions *(indicator weight = 1)*
f. Source code quality *(indicator weight = 0,6)*
g. Start programming as soon as possible *(indicator weight = 0,8)*
h. Continuous testing *(indicator weight = 1)*
i. Detailed project documentation *((indicator weight = 1)*
j. Effective communication among team members and user *(indicator weight = 0,4)*
k. User is integrated into development process *(indicator weight = 1)*
l. People motivation *(indicator weight = 0,6)*
m. Decision power *(indicator weight = 1)*
n. Maximum compliance with original requirements *(indicator weight = 1)*
o. User satisfaction *(indicator weight = 0,3)*
p. Methodology adaptation *(indicator weight = 0,6)*

Impact on the agility index: The assessment of the answers to questions which are important for traditional methodologies (a, b, c, d, i, n) is reversed and then is multiplied by an indicator weight. Total of these values is made.

6. What are the weaknesses of the methodology you are using? To each question you can attach from 1 point (not a problem) to 7 points (critical problem with the methodology)

a. Low level of detail *(indicator weight = 0,3)*
b. Large scope, very complicated *(indicator weight = 0,5)*
c. Low level of this methodology knowledge *(indicator weight = 0,2)*
d. Low flexibility *(indicator weight = 1)*
e. User is not involved *(indicator weight = 1)*
f. Methodology is concentrated mainly on technology *(indicator weight = 0,3)*
g. Methodology demands high qualified people *(indicator weight = 0,7)*
h. Methodology doesn't contain SW processes description *(indicator weight = 0,2)*
i. High skilled project manager *(indicator weight = 0,7)*
j. Slight stress on design quality *(indicator weight = 0,5)*
k. Strong stress on design quality *(indicator weight = 0,8)*

Impact on the agility index: The assessment of the answers to questions which are important for traditional methodologies (b, d, e, f, k) is reversed and then is multiplied by an indicator weight. Total of these values is made.

7. Do you know the terms "agile methodologies" or agile approaches to software development, and do you know what they mean? (one of listed answers)

Impact on the agility index: No impact, not applied to the methodology used.

8. What do you think the advantages and strong points of agile methodologies and approaches are?

Impact on the agility index: No impact, not applied to the methodology used.

9. What do you regard as being the disadvantages and weak points of agile methodologies and approaches?

Impact on the agility index: No impact, not applied to the methodology used.

10. Assess the methodology you use in your company (if you do not use any specific methodology, assess your style of software development) according to the degree of its agility.

Impact on the agility index: No impact, subjective assessment

11. Are you considering using any specific methodology in the future (if you do not use any) or are you considering any alteration to your current methodology? (one of listed answers)

Impact on the agility index: No impact, not applied to the methodology used.

12. Assess the possible future methodology according to the degree of its agility.

Impact on the agility index: No impact, not applied to the methodology used.

13. What risk do you see in the transition to a new methodology? (multiple answers allowed)

Impact on the agility index: No impact, not applied to the methodology used.

14. If you are not considering using any agile methodology what risks can you see in using agile approaches and what are your reasons for refusing them? (multiple answers allowed)

Impact on the agility index: No impact, not applied to the methodology used.

15. Agile methodologies often have more significant demands on people. Do you consider your employees' level of knowledge and readiness to agile development to be sufficient?

Impact on the agility index: No impact, not applied to the methodology used.

16. Agile methodologies often lead to a significant increase in the "creative freedom" of programmers. Do you consider your employees' character to be sufficient?

Impact on the agility index: No impact, not applied to the methodology used.

17. Based on your experience, is there any difference between Czech and foreign employees as far as the use of agile methodologies is concerned? Choose the relevant option and give a brief description of where you see any differences. If possible, give a simple example from your practice.

Impact on the agility index: No impact, not applied to the methodology used.

18. Do you consider the method and quality of software development methodologies education at Czech universities to be sufficient? If you do not, please give a brief explanation of any possible deficiencies.

Impact on the agility index: No impact, not applied to the methodology used.