

# Value Creation by Agile Projects: Methodology or Mystery?

Zornitza Racheva, Maya Daneva, and Klaas Sikkel

University of Twente, Drienerlolaan 5, Enschede 7500,  
The Netherlands  
{z.racheva,m.daneva,k.sikkel}@utwente.nl

**Abstract.** Business value is a key concept in agile software development approaches. This paper presents results of a systematic review of literature on how business value is created by agile projects. We found that with very few exceptions, most published studies take the concept of business value for granted and do not state what it means in general as well as in the specific study context. We could find no study which clearly indicates how exactly individual agile practices or groups of those create value and keep accumulating it over time. The key implication for research is that we have an incentive to pursue the study of value creation in agile project by deploying empirical research methods.

**Keywords:** business value, agile development, systematic review.

## 1 Introduction

In many organizations today, the IT departments undergo a cultural change through which the once-dominating cost-centric view of IT is being replaced by a value-centric view. For companies, to be able to support this transition in culture, they need to provide senior management with an explicit means to show the link between the IT solutions being adopted and the benefits resulting from them. This is particularly necessary in the context of agile software development, as new agile methodologies are being adopted and need to prove their merits. A key characteristic of any agile approach is its explicit focus on business value [1]. Essentially, in agile software project, the development process is a value creation process. Indeed, the agile community established a common understanding [2] that (i) the main purpose of an agile project is to deliver maximum business value for the client and that (ii) agile approaches deliver business value fast and early in the project.

In this paper, we take a closer look into the ways in which agile software practices create value in agile projects. We have set out to answer three research questions (RQ): RQ1: *What concepts of business value are used in agile context?* RQ2: *In which way do agile projects create business value?* RQ3: *In which way do specific or individual practices influence the creation of business value?* We consider RQ3 to represent a more concrete look into the process of creation of value and, thus, can be considered as a refinement of RQ2. In the course of our research action, however, it turned out that we could not answer RQ3. In spite of our efforts, based on the results

of the study we could not provide a complete answer to that question. The fact that we could not find enough evidence is in itself surprising, and is one of the results of the study. Nevertheless, as we have no enough evidence, in the course of the paper we will not discuss further this question.

To answer our research questions, we have performed a systematic review [3] of literature. In the next section, we provide background on agile software development and business value as its central theme, and on our motivation for caring out this research. Section 3 describes the details of our systematic review (SR) process and Section 4 presents the results. Section 5 assesses our answers to the research questions and discusses implications for researchers. Section 6 analyses the possible validity threats, in section 7 we compare our results to previous studies, and Section 8 concludes the paper.

## 2 Background and Motivation

### 2.1 Agile Software Development

This section is an introduction for readers who are less familiar with agile software project contexts and agile software development and management approaches.

Agile approaches to software project delivery and to software product development can be considered a paradigm, a project management philosophy, a culture, an attitude, and a state of mind. All these rest on the ‘minimalist’ principle of organizing work in the software development process, meaning a conscious choice in carrying out those tasks which directly create value for clients and leaving out anything that is deemed “waste” [4]. The latter refers to all work and work products not directly contributing to the development of the desired software, for example spending time on implementing features that are not specified by any user story or on producing an artifact not explicitly asked by the clients. The ‘minimalist’ principle is fundamental to the ability of the agile approaches to cope with project uncertainties. In that sense, this principle can be seen as a reaction to the ‘plan-based’ paradigm which assumes that problems are fully specifiable and that predictable solutions exist for every problem [4]. Agile approaches, such as Extreme Programming (XP), SCRUM or CRYSTAL, for example advocate requirements engineering (RE) through the software product development cycle in small and informal stages. That is, instead of engineering the requirements upfront, one lets requirements emerge during development. Agile software process practitioners deem this approach particularly valuable for software producers in a context that includes highly uncertain requirements, experimentation with new development technology, and clients willing to explore the ways in which an evolving product can help their business goals. If we compare agile RE and ‘plan-based RE’, one could notice two important differences [1]: (i) (re)prioritization happens at inter-iteration time, which means that the project team anticipates and plans as many reprioritization sessions as the number of project iterations, and (ii) (re)prioritization is based mostly on business value, that is, the highest priority features get implemented early so that most business value gets realized.

All agile software approaches share the same ‘minimalist’ principle, but, despite that, not all of them are directly comparable in terms of scope and content. For example, an important distinction exists between agile software development (ASD) and agile project management (APM) approaches. While the first class of approaches are defined as “evolutionary approaches which are collaborative and self-organizing in nature, producing high-quality systems that meets the changing needs of stakeholders in a cost effective and timely manner” [1], the APM approaches are defined as “the work of energizing, empowering and enabling project teams to rapidly and reliably deliver customer value by engaging customer and continuously learning and adapting to their changing needs and environments”. We make the note, however, that in this paper we treat ASD and APM practices in the same way. That is, when we use the term ‘agile practice’ we mean a practice which can be part of either software development or project management. In the next sub-section, we narrow down the discussion to the concept of business value as business value is what motivates the adoption of agile practices in the first place.

## 2.2 Related Work

Systematic reviews of empirical studies of ASD and APM practice have been contributed by a few authors [1,4,5]. However, the research questions asked in these studies are different from ours. The first review [5] dates from 2002 and answers the question “What makes a development method an agile one?” This SR synthesizes existing literature to characterize the state-of-the-art practice and compare agile methods by pinpointing out their similarities and differences. Furthermore, a comparative analysis of nine agile methods was published in a report in 2002 [1]. We make the note that these two publications [1,5] found scarce empirical support to exist for the nine reviewed methods.

The second SR [4] dates from 2008 and its objective is to answer the questions of “What’s currently known about the benefits and limitations of ASD?” and “What is the strength of the evidence in support of these findings?” These authors also investigated what the implication of ASD studies are for the software practitioners and software engineering researchers. This SR identified four categories of ASD publications: (i) those pertaining to ADS adoption, (ii) to human and social factors, (iii) to customer and developers perceptions and (iv) comparative studies of ASD processes and alternative ones. With respect to each category, the SR [4] indicated a number of reported benefits and limitations of agile development. A key finding of this SR was that “the strength of evidence is very low, which makes it difficult to offer a specific advice to industry and that the research community “needs to increase both the number and the quality of studies on ASD”.

Clearly, the research questions of our SR were not the objectives of the previously published reviews. In this sense, the present study complements the existing research by other SR authors. In Section 8, we will compare our findings with those previously published and we will see points of convergence and divergence between us and other SR authors.

### 2.3 The Concept of Business Value

The term BV is being used in management and financial economics as an informal term that includes all forms of value that determine the health and well-being of the firm in the long-run. In the context of agile development the term Business Value appears in the majority of publications at agile software development conferences (for example, the annual AGILE conference series, e.g. [www.agile2008.org](http://www.agile2008.org)). Typically, it is used in phrases like ‘companies should focus on delivering business value’, or ‘agile methods help deliver business value’.

That this term is central to the agile community is not surprising, as one could see from Section 2.1. What we found surprising, however, is that while studying the agile software development literature for more than a year, we consistently made two contradicting observations with respect to the concept of business value. On one side, practitioners are occupied with how to measure the creation of business value through the software development process by translating anything valuable into dollar value. On the other side, intuition suggests that in agile projects it makes sense to interpret business value as a multi-dimensional concept, just as it is in studies on business value of IT in general.

These observations motivated us to look deeper and in a more structured way at agile literature and get to know what is the understanding of business value that is particular to the agile context and in which particular ways agile practices contribute to the value creation process. Our goal is to uncover such knowledge, to identify the different viewpoints presented in current agile software engineering literature and to derive conceptual categories which are significant in developing a deeper understanding of the phenomenon of creating business value in agile software projects. In this paper, we talk about the term BV in general and as understood in the agile community. As seen from the definition used in the economic sciences, it is not a well defined concept. Still, if our purpose is to uncover how an ASM or an APM method increases (or influences) it, we need an operationalizable definition of this concept. In this sense our study can be considered as a first step in this direction.

## 3 The Research Method

As per SR guidelines [3], we used the RQs for determining the content and structure of the SR, for designing strategies for locating and selecting primary studies, for critically evaluating the studies, and for analyzing their results. We implemented the following SR process:

We used the following search strings: (1) business value AND iterative development, (2) business value AND agile projects, (3) business value AND scrum, (4) business value AND XP. These search strings are the result of a learning process, that is, we experimented with a variety of combinations of these words in order to test synonyms used in literature and to cover the variety of agile software development and agile project management concepts. We want to underline that we performed searches with alternative strings: feature driven development AND business value; crystal clear AND business value; agile development AND benefits; lean development AND business value. They didn’t return any papers. We considered it important to proceed like this because no standardized, consistent terminology exists with respect to the topic of our study.

We used the Boolean “OR” operator to concatenate the four search terms: 1 OR 2 OR 3 OR 4. Our search strategy included six electronic databases, namely (i) ACM Digital Library, (ii) IEEE Xplore, (iii) ISI Web of Science, (iv) Kluwer Online ScienceDirect – Elsevier, (v) SpringerLink, (vi) Wiley InterScience, and (vii) Scopus, ensuring our search was applied to journals, magazines, conference/workshop proceedings published since 2000. As the topic of business value in agile software development is closely related to the practice, we decided our search strategy to include the Agile Journal ([www.agilejournal.com](http://www.agilejournal.com)) which is the most popular practitioner-centric online publication venue of the agile community. The Agile Journal publishes monthly issues with articles on various subjects concerning ASD and APM. We make the note that there is an overlap between Scopus and the other databases we used in terms of citation data [6], e.g. the sources of IEEE and Springer are included in Scopus. As indicated in SR methodologists [7], the role of deploying a multiple-database-searching strategy is twofold: (1) to ensure a coverage including additional sources (unique coverage) and (2) to take advantage of differences in indexing across databases to increase the chances of retrieving relevant items that are in both databases (incremental retrieval).

We performed the searches between Nov 1 and Nov 28, 2008, applying the search query individually to each electronic database. We make the note that not all databases, which we used, allow for queries composed of complex Boolean expressions. For those ones, which did not process complex queries, we run separate searches and, then, we used the union of the results obtained. We adopted this practice because the second author used it in her earlier SR study [8] and found it to work well. We applied the search query to the titles, abstracts, conclusions, and keywords of the articles in the identified databases and conference proceedings. We excluded editorials, prefaces, summaries of articles and tutorials, workshops, panels and poster sessions. We also did not include PhD theses and technical reports. The published sources we reviewed were written in English only and included both qualitative and quantitative research, from scientists and practitioners.

We were surprised to retrieve only a small number of papers from the scientific electronic libraries. For example, there was 1 paper from Springer, 17 from Wiley, 19 from IEEE and 67 from Scopus. In the Agile Journal, the only search string we used was “business value”, as we assumed that the publications would be relevant to the agile software development topic. The result was 50 articles.

After identifying the potential sources, we have screened all titles, abstracts and conclusions to extract the ones we consider relevant to our research effort. We consider relevant those papers in which (i) there is an explicit description of what the authors understand under the term ‘business value’, and/or (ii) there is some indications of the ways in which business value is created, accumulated, measured and tracked throughout the agile project. We highlighted all phrases that contain author’s understanding of the nature of business value. We used this information threefold: first, to catalogue existing definitions of business value in agile, second, to compare them and identify areas where the definitions overlap, complement each other or diverge, and third, to build conceptual categories which could serve researchers and practitioners to clearly see what the current literature refers to, when using the term business value. In the next sections, we first present our results and offer a discussion on them (in Section 4). We, then form answers to our research questions in Section 5. We chose this lay-out in

presenting and analyzing our findings as we believe that this helps the readers understand clearer how we derived the answers to our research questions.

## 4 Results

Our overall observation from reviewing the papers is that most of them turned out to be irrelevant according to our inclusion criteria described above. A large number of materials in fact did contain the terms business value and agile, but we found that business value itself was not elaborated in either of the two senses mentioned above.

Our SR indicates that the authors of the papers we reviewed consider business value a self-evident concept. It seems that business value concepts reflect condensed meanings of general terms which the authors of the papers assume everyone shares.

We found no paper that provides a rigorous definition of business value in agile context. With exception of five papers [9,10,11,12,13] in the literature we reviewed, the understanding of business value was either implicit, or taken for granted.

In what follows, we first discuss the definitions we catalogued from our review, and then we compare them to distil some characteristic features of the understanding of business value in the agile literature. Last, we present the results of our application of a coding process on the reading materials we deemed relevant. These results are conceptual categories which we think help understand and reason about the business value concept in agile project context.

### 4.1 Definitions of Business Value

The definitions we discovered are presented below in Table 1.

**Table 1.** Definitions and sources

| Authors         | Definitions   |
|-----------------|---|
| Barnett [9]     | “...business value, as measured in business revenue, stock price, market share, or other business metrics. Value is in the eyes of the customer...”   |
| Patton [10]     | “Business value is something that delivers profit to the organization paying for the software in the form of an increase in revenue, an avoidance of costs, or an improvement in service”.  |
| Pettit [11]     | “Business value is a communication vehicle: we use business value to communicate value, priorities, motivation”.  |
| Rawsthorne [12] | “Business value is what management is willing to pay for; value can only be defined by the ultimate customer. And it's only meaningful when expressed in terms of a specific product (a good or a service, and often both at once), which meets the customer's needs at a specific price at a specific time”. |
| Poole [14]      | “Might not be possible to define the business value of IT independently of other activities. What is business value:<br>$Business\ value = F(x) + F(y) + F(z) + ....$<br>That is, a complex function where we must balance multiple things ...while they are changing!”                                       |

An interesting observation is that all of them are from practitioners' articles. We explain this with the facts that (i) we could not find scientific publications, particularly dedicated to explaining the notion of value in agile context, and (ii) we believe that the authors assume that the concept of business value is self-evident because it is extensively studied in economic sciences. (For more information on the topic of business value of IT, we refer interested readers to the reference [15]).

For the sake of completeness, we also mention published works of other authors who discuss ways of realizing value [16,17, 18]. We note that these works, however, don't provide any definition of value, which is the reason to leave them out of this study.

In addition to the above definitions, we identified seven other publications [13,19,20,21,22,23,24] which discuss the topic of business value without using explicitly the term "business value" itself but terms synonymous to it. We list these six for the sake of completeness:

- (i) three papers [19,20,24] use the concept *Earned Value* in agile settings. All three base this concept on the earned value measure used in economic sciences, in order to track progress or velocity of an agile project. According to [19,20,24], Earned Value is a project management technique to measure, at a specific date, the progress and performance of a project against the plan, and to estimate future performance.
- (ii) one paper [23] uses the term *perceived business value*. According to the authors, this concept means the particular context of multiple projects and optimizing value in this case.
- (iii) one paper [13] proposes the concept of *Earned business value* (EBV). It defines a measure, which can be used to track the value of the requirements being delivered. The measure helps calculating the relative value of the work done compared to the whole project. Agile earned business value is a ration calculated by using the formula:

$$EBV = \text{the-percent-of-value-delivered} / \text{the-percent-of-cost-consumed}.$$

- (iv) two published sources [21, 22] use the term *Economic value* interchangeably with business value. The second source [22] defines the Economic Value through the net present value (NPV) in the formula:

$$NPV = \text{AssetValue} / ( 1 + \text{DiscountRate} )^{\text{DevTime}} - \text{DevCost}$$

We note that the term 'Asset Value' (meaning the dollar returns of a project) is neither defined, nor traced back to tangible project characteristics. Instead, it is taken as a given in the calculations.

## 4.2 Comparison of the Concepts

Our comparison of the definitions presented in the previous section was done by applying the following steps: we first identified the original authors' terms used in discussing business value and then, we compared them to see points of convergence and divergence and to characterize these. This process of constant comparison is borrowed from Grounded Theory research methodologists [25] who suggest it as a qualitative analysis technique for research settings like ours. In our comparison, we also

checked for each definition the context of its intended use. This analysis revealed the following characterizing features of the business value concepts we found in existing literature:

*1. Business value in practice tends to be qualitative:* Our observations from the reviewed sources do indicate that there are quantitative definitions of business value. However, we found evidence suggesting that these definitions, when used in practice, are applied at project level. We found no study suggesting that a quantitative definition of business value is used when authors attempt to see how much value is contributed by the deployment of an individual agile practice or by a group of practices. We could also find no study which provides evidence that business value and its accumulation over time has been tracked quantitatively throughout the project iterations. Clearly, if one is to see how agile development creates business value, one needs “to tie value back to some tangible gain for the business” [10]. For example, to “something that delivers profit to the organization paying for the software in the form of an increase in revenue, an avoidance of costs, or an improvement in service” [10]. However, our review indicates that tying back business value to gain is problematic.

*2. Business value tends to be subjective:* Our observations from the literature sources indicate that often, the term “value” is used subjectively. Patton [10] illustrates clearly this by his experiences witnessing agile project stakeholders expressing value in the following ways: “I value something if it makes me feel good”, or “If I’m representing the business, then I might view something that makes me feel good as a “business value”.

*3. The sources of business value drive requirements prioritization:* Our observation is that, more often than not, when agile projects refer to “customer”, they mean a multi-stakeholder setting in a client organization. In such a setting, if requirements are prioritized and re-prioritized from the perspective of the “customer” at inter-iteration time, then the relative priority, which is given to each stakeholder group behind the label “customer” is the actual driver for the prioritization process. Patton [10] illustrates this point drawing on the matter that “different people consider different things valuable” and that “prioritizing work becomes a tug-of-war in those circumstances”. (Patton [10] warns that “If we share a common idea of what’s valuable, then we needn’t pull in opposite directions.”

*4. Business value of the IT solution requires a degree of trust:* There is a limit to the confidence we can place in business value numbers. This means that business value is not an absolute “dollar value” [11]

*5. The business value an IT solution tends to be dependent on non-IT business processes.* Our observations from the reviewed publications suggest that business value might well be related to other aspects and processes of the business. Poole [14] even warns that it might not be possible to define the business value of IT independently of other activities.

### 4.3 Perspectives to Consider When Thinking of Business Value

We identified that the understanding of business value is traced back to the perspectives of the two key groups of participants in the agile project and, in turn, their roles.



Throughout our SR, two main groups of papers emerged: (i) those dealing with creation of business value for the client organization and (ii) those discussing how a development organization can manage a portfolio of multiple and concurrent agile projects being done for one or more client organizations [13]. The two groups of papers clearly indicated that each perspective represented a unique understanding of what is of value and how to achieve maximum value.

From the client's perspective, the value is defined by the clients themselves. Indeed, most of the literature sources we studied relate to business value as understood from the client's perspective.

Furthermore, from the perspective of an agile software development organization, the management defines the relative business value of each project in the portfolio of projects, which the organization is engaged in, as a software supplier. The management team typically uses projects' business value in the process of performing trade-off analysis and balance between resource demands coming from different projects. We make the note that in addition to the above, in case of a development team in a client-supplier contractual relationship, the value for the team is to satisfy the client's needs, so that the client will eventually come back the next time, which has a direct impact on the revenue of the developer [26]. This is different in the case of an IT-department within a company, where the IT-team has (i) to make business management happy, (ii) to help increase overall profit of the organization, and (iii) to balance between new development and other IT operations and maintenance tasks.

We make the note that we have consciously excluded the role of the end user. This is because, in the literature sources we reviewed, we could not find any evidence suggesting a linkage between the end user and the decisions influencing business value in agile projects. We believe that this is so because authors silently assume that the "customer" will take into consideration what is valuable for the end users in the client organization. Still, we think that this question is worth to be explored in detail in a future work, as it is very relevant for the value perspective.

#### 4.4 Conceptual Categories Helping Understand Business Value

Our process of making analytic sense of the reading materials by means of coding and constant comparison brought us to five conceptual categories which we deem significant in understanding business value and its creation in agile projects. A conceptual category explicates ideas, event, or processes in our observations, which we collected while running the SR. We call these categories 'significant' because we believe we can use them to make an interpretative rendering that illuminates the studied phenomenon, namely business value creation in agile projects. We think that other researchers can use these categories to define what is happening in the project and begin to grapple with what it means. The categories we discerned are these:

1. *Vision*. Multiple indications [9,19,21,27] from literature suggest the creation of business value should be driven by the vision of the organization.
2. *Business goals*. Approximately half of the papers suggest that business value must be established from business deliverables often requiring input from a range of stakeholders[27, 26].
3. *Product goals*. The majority of the agile practitioners relate business value to software product goals. For example, [20, 27] cite experiences in which product

goals were re-defined after the effect of the IT solution is known. Re-definition of business objectives after change in the project context is also possible [27]. The authors mean, for example, change in the business environment, lows, competition. Each of these events might trigger a change in the business goals and consequently – in the defined objectives for the software.

4. *Product features.* Practitioners indicate that it would be of benefit if there is a way to quantitatively assess the business value of each feature of the software product. As Poole says [14], only by assigning business value, in hard currency, to each IT deliverable and even every feature of a deliverable, can business truly manage the relationship with IT effectively. More than  $\frac{3}{4}$  of the publications are concerned with the question how to measure the part of the whole business value (at project level) which is included (encapsulated) in each feature. For example, [13] assigns to the whole set of features the value of 100%, and each separate feature is treated as a fragment of the whole functionality and, in turn, is measured in its relation to the whole. However, we found no study that describes a project in which this was done.
5. *Agile practices.* There seems to be a common agreement in the literature that some practices help more the process of creating value than others [21,28]. Gurses [28] highlights the importance of knowing the value that the particular agile practices create. However, we found no study which suggests how exactly certain groups of practices add more value and even what “more value” means in agile context.

To check whether we have grasped what is significant, we attempted to use these categories on examples of real-life projects described by practitioners in the agile literature. For the purpose of illustration, in this section we refer to the experiences reported by Yahoo’s Advanced Products team [27]. At Yahoo!, this team develops innovative product ideas before formally launching them into the Yahoo! Network. The reported experiences [27] in using ASD and APM approaches date from 2006 and are about Mixd (<http://mixd.yahoo.com>), a group mobile messaging and media sharing tool for people who want to organize and remember gettogethers. This t was, built and launched by Yahoo’s Advanced Products team in a nine month timeframe. In what follows we show how the conceptual categories, described earlier in this section, can be used to makes sense of the business value creation in Yahoo’s case.

As per Yahoo’s 2007 annual report<sup>1</sup>, Yahoo’s purpose is formulated as “powering its communities of users, advertisers, publishers, and developers to create indispensable experience, built on trust”. The *vision* of the company is to have these communities provided with internet services that are essential and relevant. In line of their vision, Yahoo set the *business goal* of the Mixd project “to get to the target youth market as quickly as possible, while still providing a compelling user experience, and iterate on the product quickly”. The *product goal* was “to help communities of 18-25 year olds connect both online and offline, share ideas and information, and socialize with each other using their personal cell phones”. Yahoo refers to the product goal as to ‘core goals’. At the start of the agile process, as per the Yahoo’s Mixd experience report [27], this goal was reformulated in a specific client-centric way as follows: “*it’s 5pm on a Friday night and I want to hang out with my friends. What do I do?*”. This

<sup>1</sup> The report is publicly available in pdf-format at Yahoo’s web site.

was to reflect the Yahoo Advanced Team's assumptions that framed their actions at the beginning of each agile process-iteration which followed. The experience report indicates the translation of this product goal into the following key groups of *product features*: to allow people (i) to create add-hoc groups, (ii) share mobile photos and video and (iii) see it all on a website later. These product features - which support the 'core goal' as well, are called 'core features'. The report does not provide details on whether business value was quantified or not, it gives a detailed account on how the team involved their clients into the agile development process in a way that helped discover the 'core features' and ultimately develop a product with "more business value" than it was thought possible at the formulation of the original product concept. At the very first iteration, the Advanced Product Team started with a concept of a product which was a web-based invitation application (for example, similar to Evite: <http://www.evite.com>). Throughout the agile process and with consistently high user involvement - by means of regular feedback at inter-iteration time, Mixd ended up as a mobile social networking product. It was through these feedback points that Yahoo's team managed to change their course of action in a timely fashion so that it tuned the functionality to their users' wants and delivered in each iteration "new chunks of functionality working without breaking what already worked". At inter-iteration time, the Yahoo team filtered most product decisions by using their *product goal* and prioritized *product features* by asking if the feature was absolutely necessary to help the user accomplish their goal of hanging out with friends. The team "brutally cut features" which did not address the product goal. For example, one of the features included in the initial Mixd solution proposal was a way for the Yahoo user to get updates via email, instead of mobile phone. Yahoo's Advanced Products team thought "this was a terrific add-on for people who didn't want to get updates or converse on their mobile phone" [27]. They also found "This feature required a significant amount of effort, but could be completed in time for our launch. We once again bought up the core problem statement and realized that the feature diluted the key focus of the product and that it added extra UI complexity where we didn't need it. We cut the feature and instead focused on strengthening the other features".

## 5 Summary of Results and Implications

This study has addressed the questions of *What concepts of business value are used in agile context? (RQ1)* and *In which way do agile projects create business value? (RQ2)*.

For RQ1, our findings are that (i) the majority of papers in agile software engineering literature do not define the concept of business value, (ii) the business value concepts rest on a definition of Earned Value as used in economic sciences, and (iii) authors rest on the premise that business value is translatable into dollar value. However, we found that this 'translation' is problematic.

For RQ2, we could not find sufficient evidence that allows us to formulate an answer. The publications included in our review offer almost no evidence pertaining to the specific ways in which agile practices create and keep accumulating business value throughout the project.

However, the fact that RQ2 could not be answered by means of a systematic literature review is, in our view an important finding. The idea of focusing on business value is pivotal in the agile paradigm, yet in which way this value is created seems to evade precise description. Why? At this stage we can only speculate at this. Our intuition says the fault isn't in the agile practices, but in the very concept of business value, which turns out to be rather more slippery and volatile than the most of the authors of studied papers seem to assume implicitly. If business value often cannot be given very accurately, it follows that it is hard to describe exactly how an agile project contributes to it.

If we do want to further investigate the value of agile practices, a different type of research is called for. The key distinguishing feature of the agile practice is re-prioritization, based on an assessment of business value that appears to be uncertain and changing over time. The idea that re-prioritization is driven by calculating a cost function can be discarded as overly simplistic; it seems evident that some non-trivial decision making is involved. The key question, then, is how this decision making takes place. In order to gain a deeper insight in this process, we intend to empirically investigate this in agile software projects.

## 6 Limitations

There are three main validity concerns pertinent to our SR: (i) our selection of publications to be included, (ii) our analysis of definitions, and (iii) potential bias by the researchers.

The search step of our SR was executed separately by the first and the second authors. The first author searched the ACM, Springer and IEEE and the second – Wiley, Elsevier and ISI Web of Science. Each of these authors individually screened titles, abstracts and conclusions and discarded the hits returned in the respective databases. The authors worked in isolation from each other in two locations and met only after this step was completed.

We make the note here that our access to 'relevant' sources depended on the appropriateness of the search strings used. As we treated their composition as a learning process [8], the list of search strings was adapted four times and the search was re-run with the new terms. For some search strings, we applied synonyms like "business impact" and "value oriented". We also tentatively AND-combined the search strings pair-wise and queried the databases. The resulting list of papers had reduced the number of items, which were less than 10% of the items resulting from using one search string alone. In half of the cases with pair-wise combined strings, the resulting paper list was empty or contained only one or two papers. This is a hint that our search strings are only slightly redundant.

Furthermore, approximately half of the selected papers were reviewed by both researchers. For these papers, we consistently observed a consensus. Whenever there was disagreement, the points of disagreements were discussed until both researchers arrived at a consensus.

We believe that the threat to validity due to researchers' bias is minimal, because no one of the authors (i) has published a study which is included in the SR or (ii) is in a close research-collaboration relationship with the authors of included studies.

## 7 Comparing Our Findings to Previously Published Related Work

When comparing our SR and the earlier published SRs [1,4,5], we consider that our findings converge with the earlier published SRs in two respects: First, similarly to the other authors, we found that the existing sources of definitions of business value are practitioners' reports. As Abrahamsson et al indicated in 2002 [5], back at the time of their SR, the existing evidence consisted primarily of practitioners' success stories. Second, the key implication of our study is a strong incentive for carrying out empirical research. This converges with the finding of Dyba et al [4], as stated above.

Last, we make the note that the SR by Dyba et al is concerned with the concept of 'benefits' of agile practices and that we thought that the concept of 'benefits' in [4] could be related to the concept of business value. However, when we checked what the authors mean, we found that the notion of benefits in [4] is different from what we mean when referring to 'business value creation'. As a matter of fact, we counted automatically the occurrences of the word combination 'business value' in [4] and we found only two of them.

## 8 Conclusions and Future Work

A systematic review on concepts of business value in agile software engineering literature yielded the following findings:

1. In the literature on agile software engineering there is no elaborated definition of business value.
2. Practitioners offer definitions which translate business value into dollar value. However, we found that this 'translation' is problematic.
3. The notion of business value is slippery and highly volatile.

We acknowledge that at this point, the question "In which way business value is created in agile projects" remains unanswered by our systematic review approach. We only uncovered scarce indications about specific instances of value being brought by means of specific agile practices [10,16,17]. However, because these instances stem from anecdotic experiences, we could not deem them good enough for forming any conclusion.

We are really surprised that we couldn't find a more profound answer. This raises the question whether there is an existing representative body of knowledge on the subject, which might have been uncovered by means of other research approaches. Or is it time that researchers and practitioners look more closely at the phenomenon of value creation? This gives us the incentive to do further empirical research on how people make decisions in agile projects based on people's concepts of value. For this purpose we will apply another empirical method, following the recommendation in [29]. At the time of writing this paper, we are planning case study research at three agile software companies in the Netherlands.

## Acknowledgements

This research has been funded by the Netherlands Research Foundation (NWO) under the QUADREAD project and the CARES project. The authors would like to thank Roel J. Wieringa, Siv Hilde Houmb, Erlend Engum, Luigi Buglione, Thijs Munsterman and Eltjo Poort and all the members of the QUADREAD research team for sharing ideas on the topic of business value. We are also indebted to the anonymous reviewers for their comments which helped us to improve the quality of this paper.

## References

1. Abrahamsson, P., Salo, O., Ronkainen, J., Warsta, J.: Agile Software Development Methods: Review and Analysis, VTT Technoical Report (2002)
2. Agile Manifesto, <http://agilemanifesto.org/principles.html>
3. Kitchenham, B.: Procedures for Undertaking Systematic Reviews, Joint Technical Report, Computer Science Department, Keele University (TR/SE-0401) and National ICT Australia Ltd. (0400011T.1) (2004)
4. Dyba, T., Dingsoyr, T.: Empirical Studies of Agile Software Development: a Systematic Review. *Journal of Information and Software Technology* 50, 833–859 (2008)
5. Abrahamsson, P., Warsta, J., Siponen, M.T., Ronkainen, J.: New Directions on Agile Methods: a Comparative Analysis. In: *Proc. of ICSE*. IEEE CS Press, Los Alamitos (2003)
6. Bosman, J., Mourik, I.v., Rasch, M., Sieverts, E., Verhoeff, H.: Scopus reviewed and compared: The coverage and functionality of the citation database Scopus, including comparisons with Web of Science and Google Scholar, p. 63. Utrecht University Library, Utrecht (2006)
7. McGowan, J., Sampson, M.: Systematic reviews need systematic searchers. *Journal of Medical Library Association* 93(1), 74–80 (2005)
8. Herrmann, A., Daneva, M.: Requirements Prioritization Based on Benefit and Cost Prediction: An Agenda for Future Research. In: *Proc of the Int. Conference on Requirements Engineering (RE 2008)*, pp. 125–134. IEEE, Los Alamitos (2008)
9. Barnett, L.: Agile Projects Must Measure Business Value. *Agile Journal* (January 2007), <http://www.agilejournal.com/content/view/211/76/>
10. Patton, J.: Ambiguous Business Value Harms Software Products. *IEEE Software* 25(1) (January/February 2008)
11. Pettit, R.: Business Value Applied: Aligning The Day To Day With Business Imperative. *Agile Journal* (January 4, 2007), <http://www.agilejournal.com/content/view/206/33/>
12. Rawsthorne, D.: Managing the Work in an Agile Project, <http://www.netobjectives.com/files/resources/downloads/ManagingTheWork.pdf>
13. Rawsthorne, D.: Calculating Earned Business Value For An Agile Project. *Agile Journal* (June 2006), <http://www.agilejournal.com/articles/articles/calculating-earned-business-value-for-an-agile-project.html>
14. Poole, M.: Business and IT – A Marriage Made in Heaven? *Agile Journal* (October 6, 2007), <http://www.agilejournal.com/content/view/627/76/>
15. Kraemer, K.L., Gurbaxani, V., Dunkle, D., Vitalari, N.: Business Value of Information Technology (Eight Dimensions of Business Value)

16. Favaro, J.M.: Managing Requirements for Business Value. *IEEE Software* 19(2), 15–17
17. Qumer, A.: Defining an Integrated Agile Governance for Large Agile Software Development Environments. In: Concas, G., Damiani, E., Scotto, M., Succi, G. (eds.) *XP 2007*. LNCS, vol. 4536, pp. 157–160. Springer, Heidelberg (2007)
18. Setia, P., Sambamurthym, B., Closs, D.: Realizing Business Value of Agile IT Applications: Antecedents in the Supply Chain Networks. *Information technology Management Journal* 9, 5–19 (2008)
19. Alleman, G.B., Henderson, M., Seggelke, R.: Making Agile Development Work in a Government Contracting Environment Measuring Velocity with Earned Value. In: *Proc. of the Agile Development Conference*, pp. 114–119 (2003)
20. Cabri, A., Griffiths, M.: Earned Value and Agile Reporting. In: *Proc. of AGILE Conf.*, p. 6 (2006)
21. Favaro, J.M.: That Elusive Business Value: Some Lessons from the Top. In: Baumeister, H., Marchesi, M., Holcombe, M. (eds.) *XP 2005*. LNCS, vol. 3556, p. 199. Springer, Heidelberg (2005)
22. Muller, M., Padberg, F. (eds.): On the Economic Evaluation of XP Projects *ACM SIGSOFT Software Engineering Notes*, SESSION: Software process and workflow, September 2003, vol. 28, pp. 168–177 (2003)
23. Pinheiro, C., Maurer, F., Sillito, J.: Adopting Iterative Development: The Perceived Business Value. In: *Prod. of the 9th International Conference on XP, Agile Processes in Software Engineering and Extreme Programming. Lecture Notes in Business Information Processing* (2008) ,
24. Sulaiman, T., Barton, B., Blackburn, T., Agile, E.V.M.: – Earned Value Management in Scrum Projects. In: *Proc. of AGILE Conf.*, p. 10 (2006)
25. Charmaz, K.: *Constructing Grounded Theory: a Practical Guide Through Qualitative Research*. Sage, Thousand Oaks (2007)
26. Logue, K., McDaid, K.: Agile Release Planning: Dealing with Uncertainty in Development Time and Business Value, *Engineering of Computer Based Systems*. In: *Proc of 15th Annual IEEE International Conference and Workshop*, pp. 437–442 (2008)
27. Gatz, S.A., Benefield, G.: Less, Never More: Launching a Product with Critical Features and Nothing More. In: *Proc. of AGILE Conf.*, pp. 324–327. IEEE CS, Los Alamitos (2007)
28. Gurses, L.: Increasing Business Value by Adopting Agile Methods. *Agile Journal* (May 8, 2007), <http://www.agilejournal.com/content/view/410/>
29. Easterbrook, S., Singer, J., Storey, M.-A., Damian, D.: Selecting Empirical Methods for Software Engineering Research. In: *Guide to Advanced Empirical Software Engineering*. Springer, Heidelberg (2008); ISBN 978-1-84800-043-8 (Print) 978-1-84800-044-5 (Online)