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The Contradiction of Agile Measures: Customer as Focus, but Process as Measured?

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Abstract

Performance measures are being used in the agile approach as a powerful tool to understand the customer's impact of a software delivery. However, it is common to find measures related to the process instead of the customer, which would cause the team to forget the customer value delivery.

This research study adopts a systematic mapping process to understand which agile approach is related to performance measures, what kind of measures are being used, and if the papers are focused on product measures or process measures.

The analyzed articles showed that Scrum is the most frequently referenced agile approach that mentions measures. However, the review shows that the focus was on process measurements, while, despite the rhetoric about customer focus and agility, product measurements appear less important.

This result opens the way for future research to explore the consequences of adopting performance measures that are related to this high emphasis on the process.

Keywords: Measures, Process Measures, Agile Process, Agile Frameworks, Agile Practices, Customer focus.

1 Introduction

One of the agile approaches' goals is to build and maintain a competitive advantage by building an attractive product for customers. This happens because agile is a management tool that brings agility, adaptability, and speed to development projects, including reduced time to market and increased development productivity (Borba, Trabasso, & Pessoa, 2019).

A performance measure as defined by Neely et al., (1995) "can be defined as a metric used to quantify the efficiency and effectiveness of an action(s)." Thus a measure can be used as a tool to verify if the goals of a company are being achieved. According to the article from Scrum.org, "Organizations adopting agile product delivery practices can easily lose sight of their real goal of improving the value they deliver, by focusing on improving activities and outputs instead of on business outcomes" (EBM Evidence-based management Guide, 2019, p.2). In this case, companies could focus unduly on the process (efficiency) and forget the goals or customer value (effectiveness), as distinguished by Neely et al., (1995).

The experience of the first author suggests that agile practitioners do indeed fall into this trap. The aim of this research then is to understand from the literature which agile frameworks, processes or practices are associated with measures, what kind of measures are being used, and if the papers are focused on product measures or process measures.

2 Research Methodology

This research used a systematic mapping strategy following the guidelines provided by Kitchenham et.al (2011) and Petersen et al. (2008). Systematic reviews are a common methodology in software engineering, as a practice focused discipline arguably analogous to medicine, and reflect the approach of the evidence based software engineering movement (Brereton et al., 2009). Less common in Information Systems, however the recommendations of Webster and Watson (2002) have advocated a similar approach to increasing the rigour of literature reviews. The first phase of the study started with a mind map drawn after initial investigations to help write the background for this research.

2.1 Research Questions

The questions that this research tries to answer are:

RQ1. In which agile process or frameworks or practices are measures actually used in the field?

This question will seek to understand if agile processes or frameworks are actively using measures to follow product performance.

RQ2. In which agile process or frameworks or practices are product measures used in the field?

This question will seek to understand if agile processes or frameworks are using measures to understand the effectiveness of the agile process, framework, or even the time performance to produce outcomes.

RQ3. Which kind of measures do the teams/company use in their agile processes/frameworks/practices?

This question will explore what kind of measures are important in the agile process and framework.

2.2 Search Strategy

For understanding what kind of measure is used in agile processes and frameworks, first it is necessary to understand which process is more relevant in agile and how are they approached. Based on a survey done by COLLABNET and VERSIONONE published in the 13th Annual State of Agile Report, the most relevant process and framework were selected to be part of the background of this study (Collabnet & Versionone, 2018). That well regarded survey regularly conducted by "one of the largest Agile project management tool vendors on the market" (Azizyan et al., 2011) was done in Europe, Asia, South America, and Africa and the results show that the most used process and framework were:

- Scrum, the 1st most common agile practice used according to 54% of respondents;
- Kanban, the 2nd most common agile practice used according to 5% of respondents;
- DevOps, used by 48% of respondents organization.

- Scaled Agile (1st Scaled Agile Framework (SAFe), 2nd Disciplined Agile Delivery (DAD), and 3rd Scrum of Scrum).

In addition, the project portfolio managers in agile and teams are relevant themes to study and could be related to measures in the processes and frameworks, as both could be part of measure generation and monitoring. The agile approaches mentioned above are chosen as the first keywords to search in the database.

The database chosen for the search was Scopus, which is a bibliographic database containing the abstract, full text and citation database of peer-reviewed literature: scientific journals, books, and conference proceedings, with broad coverage spanning technology, and business topics among others. In the limited time available for this study, restricting the scope to one comprehensive database was considered appropriate. Based on the search results the research questions and keywords were refined.

To select the search string, each keyword set was searched as a specific search string in Scopus and the title of each paper found was analyzed to make sure that the title could answer the research question. To be considered a relevant keyword set, the final result of the analysis must be that at least 60% of papers returned had their title accepted. This parameter was the first author's approach to find relevance in the result found. In parallel, a list of 5 key papers was generated, which was used as a validation list to ensure the reliability and relevancy of the searches and to evaluate the search strings.

The final search was done with the following search string, as derived in section 2.5.1 below:

((scrum OR "scal* agile" OR "project manage*" OR DevOps OR "new product development" OR kanban OR "software delivery") AND (measur* or metri*) AND agile).

The search was done with the final search string and with the inclusion criteria mentioned in section 2.3 of this research.

The exclusion criteria, mentioned previously in this research, were also applied in the papers returned.

The classification analysis step was done for each paper that successfully overcame the filter of the exclusion criteria (paper selected). The classification analysis collected the information from the full text of each paper to answer the research questions. The summary of the process is shown in Figure 1.

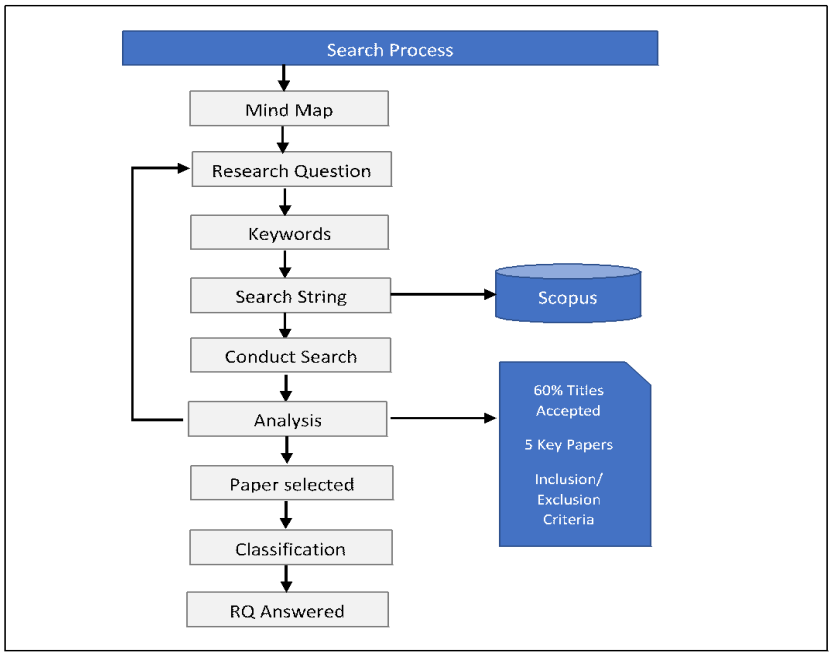

Figure 1 – Search Process Systematic Map.

2.3 Inclusion / Exclusion Criteria

To be considered a relevant paper found by the search string, these papers needed to overcome the filter of the following inclusion/exclusion criteria.

Inclusion Criteria:

- The keyword set must be found in title AND/OR, abstract, AND/OR

keywords.

- The paper is written in the English or Portuguese language.
- The paper is published between 2010 and 2020.

Exclusion Criteria:

- Document type not equal press, book, book chapter and conference proceedings.
- Duplicate papers (the same papers are retrieved from other publications).
- Papers whose titles were not related to agile processes or frameworks or practices.
- Papers where the measure found is a *proposal* about processes or frameworks or practices as a research outcome, and the measure has not yet been actively used in the field.
- Papers reporting non-empirical or conceptual work (where we define 'empirical' as in Hirschheim (2008) *(i.e., cases, [including experience reports] multiple observations as in surveys, statistical samples, … coming from the five senses)*.
- Papers whose full text cannot be accessed.

2.4 Classification

In the classification analysis, the relevant information was collected to answer the research questions. The papers were listed in Excel with fields that were filled in to identify the paper, to inform of the status of inclusion and exclusion criteria, and to classify the relevant information about measures found in the paper as follows in the table 1 below.

Fields Type in the Excel	Comments
Identify the paper	Columns to identify the paper: Paper Title, Year, DOI, Abstract, Document Type, Research method and Country origin of the paper.
Exclusion Criteria	Document Type Accept, Duplicate Papers, Title Accept, Abstract Accept, Full-Text Access, Full-Text Accept and Comments.
Classification	Columns to identify the process/framework/practice mentioned in the paper and measures found.

Table 1 – Excel with classification fields

2.5 Results of Search Strategy

2.5.1 Analysis - Identify Search Theme

As mentioned in the previous section, the title of each paper returned in the search string for each keyword was analyzed.

The title of all papers searched was analyzed and only searches had at least 60% of titles approved were used in the search string. Moreover, some limitations were applied to the searches such as year was set to be older than 2009 to select more up to date papers. This gave a decade of papers to review, which was both manageable and reflected the more recent developments in the agile movement. Besides, the search was limited to title, abstract, and keywords to select more relevant papers.

The result of this process is shown in table 2 below.

ID	*Search*	*Totality*	*Qt. Title Approved*	*% Approved*
1	"measur*" AND scrum AND agile	137	134	98
2	"measur**" and "project manage*" and agile	126	124	98
3	"measur*" AND "performance indicator*" AND agile	40	17	43

4	"measur*" AND (team* AND maturity) AND agile	29	0	0
5	"measur*" AND devops AND agile	25	23	92
6	"measur*" AND ("Scal* agile")	23	22	96
7	"measur*" AND "kpi*" AND agile)	23	9	39
8	"measur*" AND "new product development*" AND agile	12	8	67
9	"measur*" and kanban and agile	12	12	100
	Total	***427***	***349***	***82***

Table 2 – First Result Keyword Search String

The searches resulted in 427 identified papers and after the title analyses, 349 papers were approved. In this process, duplicate papers were not eliminated. The keyword sets in ID 3, 4 and 7 in Table 1 were eliminated for not returning more than 60% of the approved titles, that is, they were not considered relevant for this research.

The 5 key relevant papers chosen were found in the papers returned by the search and one was not found in the results. The 5 key relevant papers chosen were:

- Mahnic & Zabkar (2012), Measuring progress of scrum-based software projects;
- Scott & Pfahl (2017), Exploring the individual project progress of scrum software developers;
- Olszewska et al., (2016), Quantitatively measuring a large-scale agile transformation;
- Brown et al., (2013), Agility at scale: Economic governance, measured improvement, and disciplined delivery;
- Kurnia et al., (2018), Software metrics classification for agile scrum process: A literature review.

After that, the keyword "software delivery" was included in the search string and the 5th paper was found. The search for this new keyword set was done and their paper titles were analyzed and more than 60% were approved. The keyword was included in the final search string. The result of this process is shown in table 3 below.

ID	***Search***	***Totality***	***Qt. Title Approved***	***% Approved***
1	"measur*" AND scrum AND agile	137	134	98
2	"measur**" and "project manage*" and agile	126	124	98
3	"measur*" AND "performance indicator*" AND agile	40	17	43
4	"measur*" AND (team* AND maturity) AND agile	29	0	0
5	"measur*" AND devops AND agile	25	23	92
6	"measur*" AND ("Scal* agile")	23	22	96
7	"measur*" AND "kpi*" AND agile)	23	9	39
8	"measur*" AND "new product development*" AND agile	12	8	67
9	"measur*" and kanban and agile	12	12	100
10	"measur*" and "software delivery" and agile	6	6	100
	Total	***433***	***355***	***82***

Table 3 – Final Result Keyword Search String

The keyword "metric" was searched in the place of *measure* and many duplicate papers were found. However, adding *metric* in the final search string, the sum of papers was found to rise 20%. This word was used in the final search string, but not in the keyword analysis as it did not change the keyword analysis results.

The final search was generated as shown in section 2.5.2 below, applying the final search string as earlier presented in section 2.2 above.

((scrum OR "scal* agile" OR "project manage*" OR DevOps OR "new product development" OR kanban OR "software delivery") AND (measur* or metri*) AND agile).

2.5.2 Analysis - Inclusion/Exclusion Criteria

The final search was executed applying the inclusion criteria and with the search string mentioned in the last section, and 373 papers were found as shown in Figure 2. The exclusion criteria were executed and the first filter was duplicate papers that eliminated 8 papers. The filter to eliminate document type (article in press, book, book chapter, and conference proceedings) was responsible for eliminating 52 more papers. 62 titles were found that did not mention agile processes, framework or practices.

However, it was in the abstract analysis that most papers were eliminated (169), due mainly to three factors. Firstly, many papers refer to the word "measure" in a general sense to justify the research result. Secondly, some papers are not related to measures in an agile process, framework or practice. Thirdly, other papers have a research outcome as a proposal for a process, framework or practice that mentions measures, this kind of non-empirical paper could influence negatively the result of this field research, due to the measures mentioned in the paper not being actively used by any company in the market.

The third factor was discovered during the abstract analysis and it eliminated the paper 2,3 and 4 used to validate the final search. The conclusion is that the validation continues to be valid because the papers have the correct content, but the research approach "solution proposal" (Wieringa et al., 2006), is the fact that eliminates these papers.

Four papers were not found for full-text analysis. Of the total 82 papers, 31 were discarded for the same reasons found in the abstract analysis. As the figure 2 shows, 47 papers were approved for the classification stage. A list of full papers selected is available in a repository of supplementary material at zenodo.org DOI: https://doi.org/10.5281/zenodo.4183298.

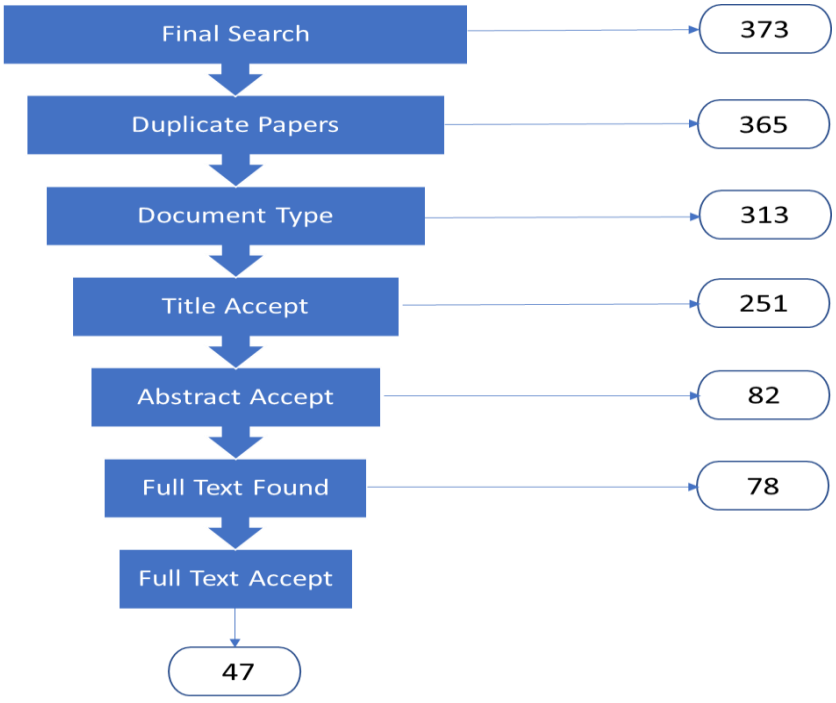

Figure 2 – Analysis process executed and results found.

3 Finding, Analysis & Discussion

This section presents the results found after classifying the full text of 47 papers approved.

3.1 Results by Paper Years

The distribution of the approved papers by year (2010-2020) is shown in figure 3. The major quantity of papers related to measuring were found in 2018, followed by 2019 and 2016. It shows that the subject of measures was relatively new and more actively treated in the last few years.

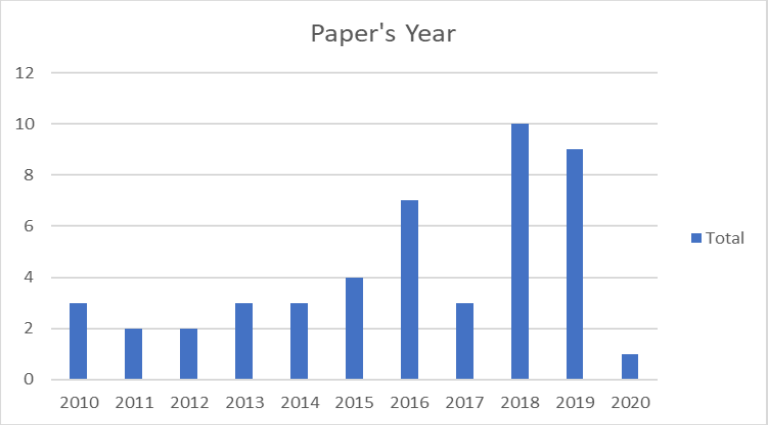

Figure 3 – Papers found distributed by years.

3.2 Results by Analyzing and Classifying Measures

Each paper approved was read to find which process, framework, or practices were mentioned and related to the measure. Measures were listed for each paper and classified as a process or product measure according to its meaning mentioned in the paper. Measures that intended to take product information about the product/service release by the agile development process/framework/practice were considered as primarily product measures.

Research Question1 - RQ1:

In which agile process or frameworks or practices are measures actually used in the field?

Scrum was the process/framework/practice most found in the papers, being found in 18 papers from 47 papers approved, as presented in figure 4. Agile Software Development was the second most found being mentioned in 13 papers, followed by DevOps with 7 papers. Kanban Teams appeared with 3 papers and Lean-Agile with 2. Scrum of Scrum, SAFe, Agile Project Manager, L-Model Agile, and Agile Testing were found with 1 paper each.

The interesting aspect of figure 4 is that the frameworks to scale agile, SAFe, and Scrum of Scrum were mentioned only one time compared with Scrum. This relative absence could be happening because the Agile Scaled framework is only relatively recently used, but compared with DevOps that has developed more recently as well, it seems that DevOps is more clearly related to measuring than Scaled frameworks.

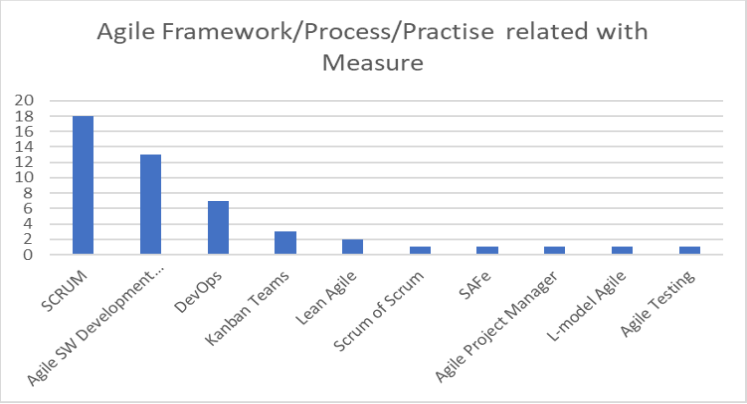

Figure 4 – Agile Frameworks/Process/Practice related to measures.

Research Question2 – RQ2:

In which agile process or frameworks or practices are product measures actually used in the field?

Based on Ktata and Lévesque (2010) who mentioned, "a good agile metric might measure a process or product", the 79 different measures found in the approved papers were classified as *process* and *product* measures. The result of this classification can be seen in figure 5. A tabulation of the full set of measures identified is available in a repository of supplementary material at zenodo.org DOI: https://doi.org/10.5281/zenodo.4183298. This figure shows that *process* measures were found in 66 papers or 80% of these, while *product* measures were found in 13 papers. Although the predominant numbers of papers associate measures with scrum, it seems the main principle of Scrum mentioned in the Agile Manifesto " Our highest priority is to satisfy the customer through early and continuous delivery of valuable software" (Beck et al., 2001), was forgotten when the subject is the measure.

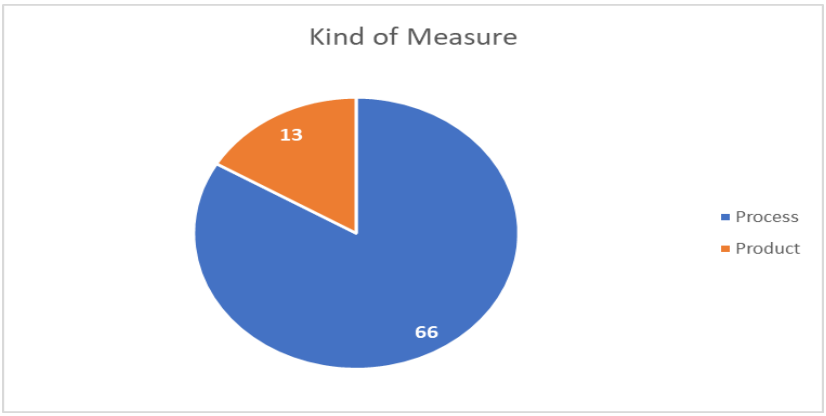

Figure 5 – Kind of measures found in the papers approved.

Table 4 shows the 13 product measures found and the frequency of each in the papers. The term 'Incident' was the measure most popular in the papers analyzed, being found in 7 papers, followed by Business KPI and Customer Satisfaction with 5 and 4 papers found. System Performance appears with 3 papers and Delivery Units Purchase, Net Promoter Score, Product Quality, Cost Model was found in 2 papers each. Numbers of Customer Scalation, Product Reliability over Time, Revenue/Sales Impact, Usability of the System and User Performance were found in 1 paper each.

Measure	***Qtde***
Incident	7
Business KPI/Value	5
Customer Satisfaction	4
System Performance	3
Delivery Units Puchase	2
Net Promoter Score	2
Product Quality	2
Cost Model	2
Numbers of Customers Scalation	1
Product Reliability Over Time	1
Revenue/Sales Impact	1
Usability of the System	1
User Performance	1
Total	***32***

Table 4- Product Measures found

Product measurements were mentioned 32 times in total. Figure 6 shows with which structure/process/practice the 32 times that the product measures mentioned were associated. Agile Software Development (ASD) appears related to 9 measures, while Lean-Agile with 8 was followed by Scrum with 7, DevOps with 4, SAFe with 2, and Agile Testing with 1.

Comparing the number of Product Measures identified divided by Papers related to a particular agile approach, we have a coefficient of product measures per paper shown in Table 5. From this table, it is possible to conclude that Scrum had fewer measures related to the product performance. On the other hand, Lean-Agile was surprising with a coefficient of 4, which means, even if only a few papers were found with measures related to Lean-Agile, the measures found were related to the product.

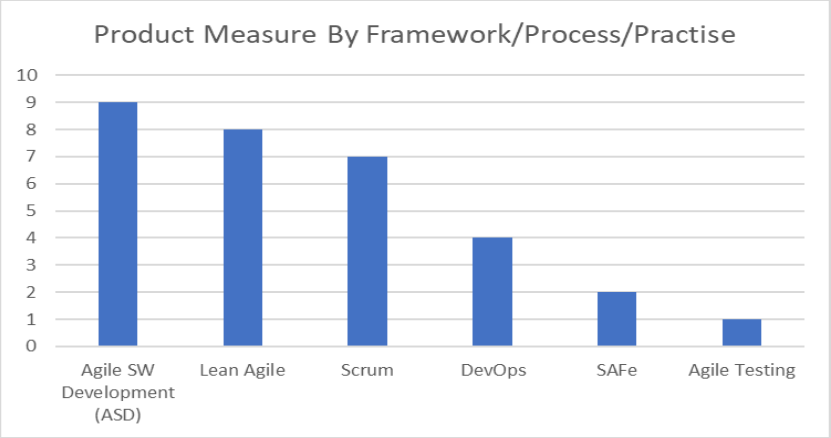

Figure 6 – Product Measure distributed by Framework/Process/Practice.

	Product Measure	***Papers***	***Coeficient (Measures/Papers)***
ASD	9	13	0.7
Lean Agile	8	2	**4.0**
Scrum	7	18	**0.4**
DevOps	4	7	0.6
SAFE	2	1	2.0
Agile Testing	1	1	1.0

Table 5- Product Measures Coefficient.

Research Question3 – RQ3:

Which kind of measures do the teams/company use in their agile processes/ frameworks/ practices?

As mentioned before, the study identified 79 different measures in the approved papers. The 14 measures most found in the papers are shown in figure 7. The most popular measure was Sprint Velocity found in 18 papers, followed by Story Points. In this case, story points were mentioned as a measure without mentioning what story points measured. Generally, story points measure velocity, which reinforces the use of the first measure of sprint velocity.

Defects appear in 9 papers, while Sprint Burndown in 8. Release Burndown and Incidents appeared in 7 papers each. Productivity appears in six papers. Function Point, Lead Time, Business KPI, and Velocity Deviation appeared in 5 papers each. At the least frequency, WIP and Customer Satisfaction appeared in 4 papers.

Only 3 product measures appear in the list of the 14 most common measures found, which are Incidents, Business KPI and Customer Satisfaction.

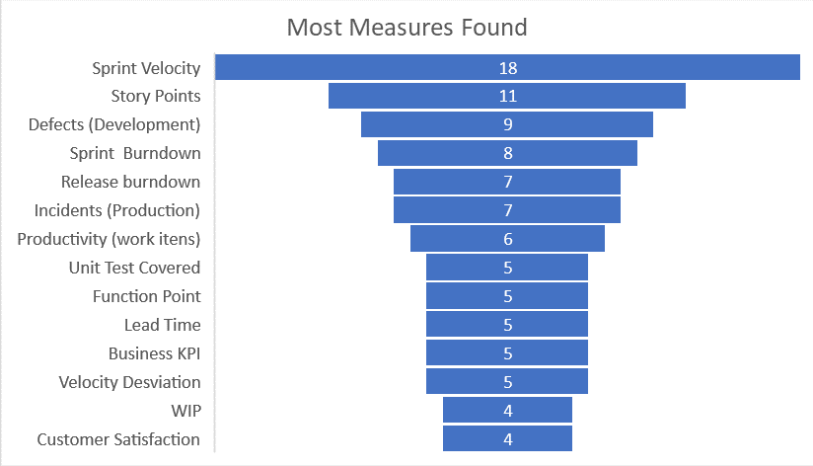

Figure 7 – The 14 measures most found in the papers.

3.3 Discussion

This research shows that the product measures have received less attention in the measurement process. Even in Scrum, where the main principle is Customer Satisfaction, Scrum does not provide guidance or show concern in their process relating to product measures. Customer Satisfaction was mentioned in only 4 papers and did not appear among the measures most commonly found in the papers. Other evidence that this paucity occurs in the field is that this measure appears in the 15th position as the most used measure in Agile Software Development, including Scrum, as shown by Padmini et al. (2015) in the questionnaire conducted in their study, "Use of Software Metrics in Agile Software Development Process".

On the other hand, Lean-Agile was related to the more agile product measures, even though being mentioned in fewer papers, it could be because lean practice is related with industry practice that it is more familiar with client satisfaction as discussed by Kersten (2018).

Lwakatare et al. (2016) argued that the dynamic nature of the DevOps concept requires focusing on measures. When the company implements DevOps, it means that soon the number of new features and products will rise in a short time, and consequently the client will be impacted more than before. It means that it is more important to monitor the product/service and customer satisfaction in short time periods.

The DevOps approach is rising in adoption by companies, as show COLLABNET and VERSIONONE in the 13th Annual State of Agile Report (Collabnet and Versionone, 2018). It means that product measures will be more and more in demand and necessary.

In relation to Scaled Agile processes, this research did not find a relevant quantity of papers mentioning measures. One hypothesis about that absence could be because the Scaled Agile frameworks are recently adopted in the market and are not mature enough to relate to measures in the process.

These findings reinforce the necessity of adopting product measures in the agile development process as suggested by the number of papers found associating ASD with product measures. In the first author's opinion, product measures could bring more maturity for the team, mainly if they draw upon, develop, and monitor this key set of outcome measures. As noted by Fontana et al., (2014), "practitioners in agile software development define maturity as the generation of specific outcomes with defined processes built with agility".

The old idea that the governance team needs to be responsible for monitoring the product measure/results as the outcome of the projects is against agile values and principles, due to eliminating the decision about measures by the teams. However, the governance team could compile the whole set of information that will be monitored by the teams and connect them with the company KPI`s.

3.1 Limitations

The first limitation was that the study discarded non-empirical papers discussing proposed measurement and method structures. This was done to focus on the research questions and to help

give a state-of-the-art view of actual use of agile metrics in the field. However, the relevance of this type of information and potential future value is recognized.

The second limitation is the depth of the analysis of the findings, which could be improved through a more in depth follow up study, which could investigate the use and the merits or otherwise of the measures identified through this mapping study.

The paper could have included an analysis of the outlets in which the papers appeared, and have broadened the set of databases we searched. However, reporting systematic reviews always entails compromise, so we chose to make available the raw data about the full set of papers returned and the full set of measures we identified in a supplementary repository (zenodo.org/...). For those who wish to follow up on this work, this information is not only interesting but should provide a useful platform for further study.

A question has been posed to us about the granularity of the measures and whether we have been consistent in their definition. At this stage we consider this a question for future consideration, with potential for a more structured taxonomy for agile measures (perhaps combining the insights of Neely et al., (1995) and Fontana (2014) into agility and maturity) to be developed,

4 Conclusion

The objective of this research was to explore which agile structures, processes, and practices were related to measures actually in use (RQ1), which agile structures, processes, and practices related to product measures (RQ2) and which measures are mentioned in these structures, processes, and practices (RQ3) . The study was based on a systematic mapping study that found 373 articles and after applying the inclusion and exclusion criteria 47 articles were approved for analysis.

The analyzed articles showed that the agile structures, processes, and practices that most mention the identified measure were Scrum. However, the study shows that the focus was on process measurements, while product measurements were less important. This was demonstrated by the amount of process measurement (66 articles) found, 5 times more than the product measurements (13 articles). Other data showing the focus on the process measure were the quantity of the product's measurements listed (3) in the 14 measures most mentioned in the documents. A primary focus on process measurement is against the main principle of Scrum that mentions the customer as the main objective of the process. On the other hand, the other structures, processes, and practices presented some limitations in this research.

The study identified a smaller number of papers related to Scaled Agile and DevOps, for example, than Scrum. This could be explained by the recent adoption of these structures, processes, and practices, but a specific study would be needed to confirm that.

To deeply understand the impact of measures on agile structures, processes, and practices, this study may suggest future research, as follows:

- The impact on the measures that the implementation of DevOps could bring. The DevOps process has made the company launch more features / products and consequently may have more impact on the customer.
- The impact on measures as far as the implementation of Scaled Agile could bring. Agile structures at scale mention measures and value flow, but what is the impact that these structures have on measures in companies?
- The scrum process has a gap in relation to real customer satisfaction. In what part of the process, is customer satisfaction adequately treated?
- The effectiveness of the measure is related to the maturity of the team. How can this relationship be demonstrated?

Nonetheless, the review has shown the puzzling contradiction that the primacy of agile measurement focuses on process, despite the rhetoric about customer focus and agility, while product measurements appear less important.

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