A LIGHTWEIGHT INDUCTIVE METHOD FOR PROCESS ASSESSMENT BASED ON FREQUENT FEEDBACK: A STUDY IN A MICRO SOFTWARE COMPANY

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Software process assessment is the most important phase in process improvement projects since it enables identification of all process issues that need to be improved. Small and micro software companies suffer from several restrictions that do not allow them to apply standards and best practice guidelines for process assessment. These companies rather implement lightweight assessment methods that can be easily tailored to their needs. This article presents a lightweight inductive process assessment method that can be adapted to specific needs of small companies. The method is based on active participation of company employees and assumes frequent exchange of information during feedback oriented working sessions in the assessed company. The method is implemented in an indigenous micro software company in Serbia for assessing software maintenance process. Four potential improvements were identified, while the best ranked one was implemented. Benefits for the company, as well as implications for practitioners from industry and researchers from academia are discussed.

Keywords: Process assessment; Process improvement; Feedback; Software maintenance; Micro software company.

INTRODUCTION

Software process assessment plays pivotal role in improving practice in software organizations. Process assessment is usually positioned as a phase in software process improvement (SPI) projects, aimed at understanding the state of the practice and proposing potential improvements. Medium and large software organizations usually implement top-down approaches based on best practice guidelines, such as *ISO/IEC 15504 - Software Process Improvement and Capability Determination (SPICE)* (SPICE, 2008) or *Capability Maturity Model Integration (CMMI)* (CMMI, 2006), which are heavyweight approaches that do not conform to small organizations due to their limited resources (Zarour et al., 2015). These top-down models are too expensive and very complicated to implement in small software organizations (Almomani, Basri, & Gilal, 2018; Staples et al., 2007), which is evident from large scale research study that revealed that less than 18 percent of small software organizations use process oriented standards (Laporte, Alexandre, & Renault, 2008). In addition, Sharma and Sangal (2018) identified that the most important inhibitor factors for SPI initiatives are the management commitment and the lack of resources, which is particularly emphasized in small organizations. Further, in an empirical study with Malaysian small and medium software organizations, Almomani, Basri and Gilal (2018) indicated that human factors such as employee awareness, leadership involvement, employee involvement, customer involvement, senior management support, staff experience, staff learning, staff skills,

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and client support are essential for success of SPI initiatives.

The focus in performance assessment within organizations has recently evolved from a pure measuring performance to acknowledging the essential role of social and cognitive issues in organizational processes (Levy, & Williams, 2004). Assessment activities within an organization highly depend on the organizational context and should be comprehensively understood in order to increase positive outcomes of assessment. According to Ferris, Munyon, Basik, and Buckley (2008), daily activities and interactions that occur in a working context frame behavior, actions and decisions within an organization and should be deeply and comprehensively investigated during the assessment. West (2013) stated that there are three paths for improving organization performance: (1) improving workers, (2) improving processes, or (3) improving technology. It is up to an organization to choose the way for improving performance, but process improvement approach can be implemented with minimal costs, and in most cases with personnel available in the organization. At the same time, process improvement enables employees to perform their tasks more efficiently, and to deliver higher quality level of products and services with less effort and costs. Further, according to West (2013), business performance of an organization can be easily narrow down to the list of processes that should be improved in order to achieve predefined business objectives. Persse (2006) suggested that process improvement success assumes building something good, using it over time, refining and improving it, and finally making it a permanent part of a business approach. According to Afshar, Brtka, and Cockalo-Hronjec (2018), intangible nature of software is the main reason for ineffectiveness of traditional processes for managing projects in software industry. Therefore, process assessment and improvement projects are common way of practice improvement in software organizations (Vasconcellos et al., 2017).

This discussion indicates that there is a constant need to design process assessment and improvement approaches that can be easily implemented in software industry. This article presents a lightweight approach for software process assessment, together with its implementation in a micro software company. The article is structured as follows. The next section outlines software process assessment approaches suitable for small software companies. The third section presents a lightweight process assessment approach, while the fourth section includes presentation of the implementation in a micro software company and the findings of the empirical study. Benefits for the company and implications for software industry and researchers are outlined, followed with discussion of study constraints and validity issues. The last section presents conclusions with emphasis on study results and contributions, as well as further research directions.

BACKGROUND AND RELATED WORK

Small software organizations differ from medium and larger ones according to many factors such as management style, product range, marketing strategy, limited resources, or time in business (Zarour et al., 2015). These software organizations differ also in a way they approach process improvement due to their limited resources and financial constraints. Larger organizations usually implement top-down or prescriptive models or approaches for process improvement, such as *ISO/IEC 15504 - Software Process Improvement and Capability Determination (SPICE)* (SPICE, 2008) or *Capability Maturity Model Integration (CMMI)* (CMMI, 2006). However, implementation of these heavyweight approaches, with quite comprehensive and demanding assessment of processes is too expensive for small software organizations (Schoeffel, & Benitti, 2012). In addition, small software companies do not have experts for planning and implementing assessment and improvement projects (Feliz, 2012).

The most critical segment in software industry is segment of very small software organizations with less than 10 employees, or very small enterprises (VSE), that do not have time, money and employees for full implementation of software engineering standards and cannot see benefits of establishing software life-cycle processes (Laporte, Alexandre, & Renault, 2008). However, since software VSEs make a significant share in software industry (93 percent of all companies in Europe and 56 percent in the US (Laporte, Alexandre, & Renault, 2008), they deserve full attention of research community and development of process assessment approaches suitable to their needs. These methods are commonly known as lightweight assessment methods, and they are suitable for small software companies (Zarour et al., 2015). These methods are also marked as inductive, or bottom-up, since they start from the real context and fit to needs of these organizations. Based on empirical study with software VSEs, Sanchez-Gordon and O'Connor (2015) indicated that management in VSEs believe that they can improve their practice by using internal informal process alterations, rather than formal SPI programs.

Savolainen, Sihvonen, and Ahonen, (2007) presented lightweight process modeling that assists a software company to determine processes' capabilities, to visualize their processes and to identify the problems in existing processes. The lightweight modeling is included in a SPI project implemented in a small software company. The SPI approach is based on three modeling sessions aimed at modeling processes, which increases knowledge about processes, process flaws and problems, and internal work distribution. Based on increased process understanding, several improvements were identified and implemented.

Pettersson, Ivarsson, Gorschek, and Ohman (2008) presented a guide to process assessment and improvement planning, which is based on lightweight assessment and improvement planning (iFLAP) method. The method uses inductive approach in identifying and implementing potential improvements. Method can be used for assessing any process area and assumes triangulation of data sources and data analysis methods that are suitable for the selected context. The authors presented also two applications of the assessment method in industrial settings.

METvalCOMPETISOFT is process assessment model suitable for small software organizations. The model is based on rapid assessment of processes which assumes that assessments do not take up too much time, does not require significant resources, and it is not rigorous (Pino, Pardo, Garcia, & Piattini, 2010). At the other hand, the assessment model meets requirements for process assessment described in literature for assessment proposals. The model is implemented in eight small software organizations that took part in the COMPETISOFT project organized in small software companies in Spain, Colombia and Argentina.

Takeuchi et al. (2014) presented ISO/IEC 29110 based lightweight assessment procedure, in which the task checklist was based on ISO/IEC 29110-5 with the customized procedures based on ISO/IEC 15504-2. The assessment trail included 8 software projects, ranged from small to large ones, and for each project 10 or more improvement issues were identified. The assessment costs are very low (about 8 hours per project), which provides the evidence that lightweight assessment is easy to implement and with low costs.

Abushama (2016) presented a Process Assessment Method for Small to Medium Enterprises (PAM-SMEs), aimed at tailoring the software process assessment as an activity within the SPI program. PAM-SMEs is based on CMMI as a base framework, but it is adjusted to environmental challenges and business objectives of small organizations. The method is successfully implemented in three small software companies, with full alignment to business objectives of these companies.

Zarour et al. (2015) conducted a systematic literature review aimed at investigating the best practices for the successful design and implementation of lightweight software process assessment methods. Literature review is based on 29 literature sources, and identified the following segments of the best software process assessment practice: assessment method, supportive tools, assessment procedure, necessary documentation for assessment, and users of method. Since the success rate of SPI initiatives in software industry is very low (Khan et al., 2017), the identified best practice in survey should help researchers and practitioners in industry to design and successfully implement their specific assessment and improvement methods.

LIGHTWEIGHT INDUCTIVE METHOD FOR PROCESS ASSESSMENT

Based on the review of literature that deal with process assessment and improvement in small software companies and insight into the everyday practice in the selected software company for the method implementation, the need for creating an easy to implement method for process assessment was identified. The method is adaptable to different contexts in small companies, which means that it starts with the real internal organization within the selected company and assumes active involvement of the company employees. Based on these considerations, the method is classified as inductive (it starts from the bottom line - the real practice in the selected context) and lightweight (it is easy to implement in a given context and does not disturb everyday activities of the employees). Since the assessment method assumes active participation of the company employees and their cooperation with the researchers, frequent feedback is essential for success of the whole assessment and improvement project. Therefore, the assessment method is called *Lightweight Inductive Method for Process Assessment based on Frequent Feedback* (LIMPAF^2).

Process assessment was implemented as a part of Software Process Improvement (SPI) initiative aimed at improving software practice in small companies. SPI project was also implemented as a lightweight and adaptive initiative with the aim to improve the practice (processes) in small software companies. Position of LIMPAF^2 software process assessment method in the context of SPI is presented in Figure 1.

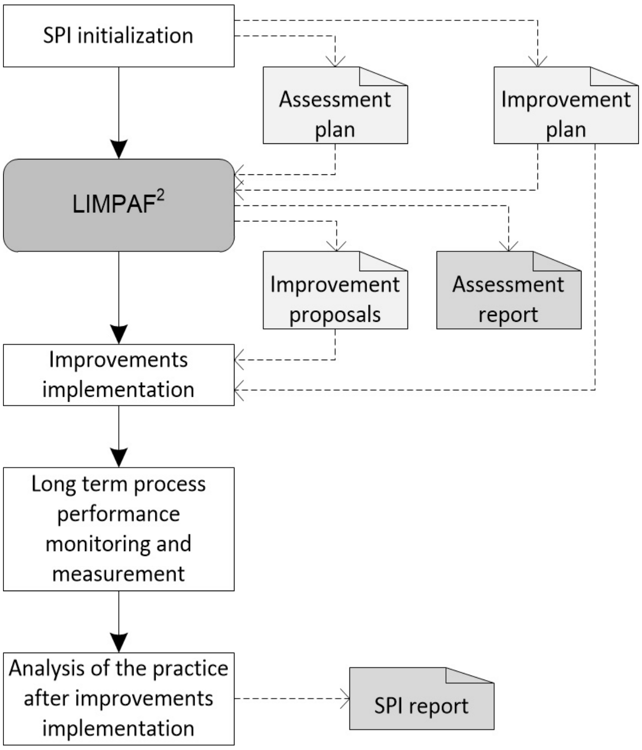

Figure 1: LIMPAF^2 in the context of SPI

The main characteristic of the LIMPAF^2 method is that the processes to be assessed are already determined during the initial phase of the SPI project. Therefore, the entire effort is directed towards assessing the selected processes. The assessment method has been developed with the following objectives: (1) to enable quick and cheap process assessment in small companies, (2) to enable easy diagnosis of selected processes and proposal of issues for improvement, (3) to allow engineers to work on their daily tasks with low engagement in the assessment process, and (4) practice assessment and adjustment of improvement proposals through frequent feedback sessions.

LIMPAF^2 method is used for identifying and prioritizing potential improvements in the practice, while the company management decides which improvements are going to be implemented. The main characteristics of LIMPAF^2 method are:

- *It is inductive*. Method starts with the real practice in the company and does not follow any prescribed theory or guideline for assessment, which classifies this method as bottom-up.
- *It is participative*. The method assumes active involvement, or participation, of all company employees in observing and assessing the current practice, which ensures identification of real issues that need to be improved.
- *It is based on frequent feedback*. Feedback is supported by organizing working meetings (working sessions) in the company, during which the employees and the researches observe the current state of the assessment

process, validate collected data and results of data analysis, and direct further activities. This approach enables controlling the assessment process, which is structured in several cycles with frequent feedback.

– *It is based on data triangulation*. Process assessment is based on data collected from different sources, which enables data triangulation and increases validity of the assessment process and assessment results. Quantitative data extracted from the company documents and the repository of tasks, and qualitative data collected by using interviews, practice observation and the company documents are used for the assessment.

Process assessment method consists of the following phases: initialization and planning, execution and reporting. Initialization and planning phase is based on the decisions documented in the document Assessment plan, which is created during SPI project initialization (see Figure 1). This document contains a time frame for implementing assessment activities, rough description of the assessment process (since the assessment method is inductive by its nature it is not possible to create a strict plan in advance), identification of data sources, and identification of employees included in the assessment.

Active participation of employees enables them to get insight into the project implementation and the scope of their engagement. Employee engagement should ensure that assessment results are grounded in the practical experience and knowledge of the employees, as well as compliance of the research findings with the real company needs and business objectives (Perry, Staudenmayer, & Votta, 1994). In this way, a full participatory approach to the practice research is realized (Bergold, & Thomas, 2012), which also ensures creation of new knowledge that is useful for the company in which the research is carried out (Argote, 2013; Dyba, Dingsoyr, & Moe, 2004).

Method implementation starts with getting familiar with the context in the company and defining the roles in the assessment project. After that, the company management and the researchers participate in a detailed planning activity. The following planning activities are included:

– *Selection of processes to be assessed*. The selection of the most important processes for assessment is based on the employee experience.
– *Establishment of deadlines*. The assessment is performed as a part of a SPI project, which means that all deadlines agree with deadlines of the whole SPI project. The next important consideration is that the assessment activities should be carried out in a way that does not disturb everyday activities in the company. The whole assessment is estimated to last six months, while particular data collecting and analyzing activities are not strictly planned because of the alignment with everyday activities.
– *Selection of research methods*. This activity relates to selection of methods that ensure achievement of the proposed research objectives in proposed deadlines. The methods should be selected in a way that ensures the most comprehensive inquiry of everyday practice, which assumes use of both quantitative and qualitative methods (Lethbridge, Sim, & Singer, 2005). Timely exchange of information between the participants in the project is provided through working meetings in the company, which are called working sessions or feedback sessions. Proposed improvements are ranked by using Multi Expert - Multi Criteria Decision Making (ME-MCDM) methods which ensures that the most valuable improvements will be implemented first (Noor-E-Alam, Lipi, Hasin, & Ullah, 2011). In this assessment method, fuzzy screening method is used (Yager, 1993).
– *Selection of data sources*. Different data sources can be selected in order to get more comprehensive and deeper insight into the practice, which ensures triangulation of data and increases the validity of the findings (in this case identified potential improvements) (Bratthall, & Jorgensen, 2002; Miller, 2008). Qualitative data are collected by using in-depth semi- structured interviews and practice observation methods (Guest, Namey, & Mitchell, 2013), while quantitative data are extracted from the company documents, through survey with clients and internal repository of the tasks implemented in the company (Kagdi, Collard, & Maletic, 2007).

Process assessment is implemented as an iterative process that includes data collecting activities, data analyzing activities, working sessions with provided feedback about the research status and the current findings, and identification and prioritization of potential improvements. Iterative process is presented in Figure 2, in which the central parts of the assessment process are feedback oriented working sessions. The feedback sessions were frequently organized in order to enable step-by-step tracking of the assessment process, which ensures that all issues will be identified and solved as they appear. Based on the session outputs, new cycles of data collecting or data analyzing activities can be initiated.

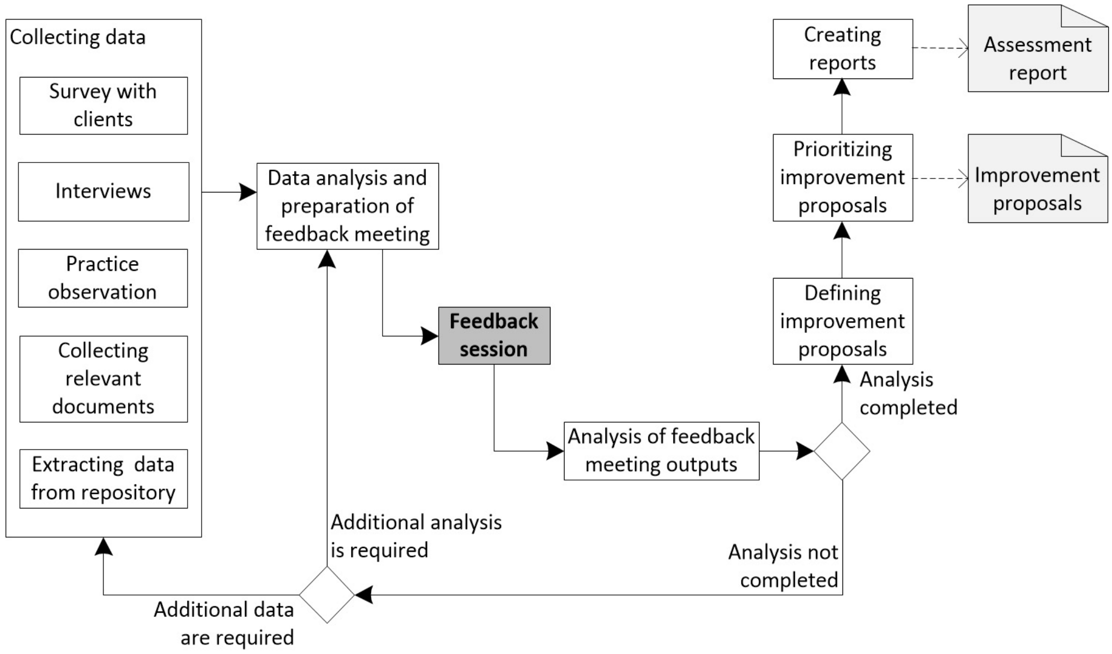

Figure 2: LIMPAF² iterative process

Data analysis is adjusted to different data types collected within the assessment of maintenance practice. The researchers and the company employees that assisted in refining the meaning of data and results participate in data analysis. Qualitative data are analyzed by using inductive thematic analysis (Braun, & Clarke, 2006; Cruzes, & Dyba, 2011), which is suitable for identifying themes within unstructured text collected during interviews and practice observation. Identified themes are refined towards clear differentiation of process improvement proposals. All constructs during the data analysis, as well as the final findings are described in detail by using memos (Birks, Chapman, & Francis, 2008). Quantitative data analysis is based on several methods, based on the aspect of the practice to be investigated. General trends in the maintenance tasks are analyzed by using common statistical methods and trend analysis (Buglear, 2001; Kanoun, & Laprie, 1996;), relations between different aspects of the assessed processes and the organizational issues are investigated by using regression analysis (Chatterjee, & Hadi, 2006), while fuzzy screening is used for ranking proposed process improvements (Yager, 1993).

Feedback sessions are organized as working meetings in the company. These sessions are used for disusing the current state of the assessment and findings, as well for directing further research activities (e.g. pointing out that additional data analysis is required for clarifying the current findings, which is presented with the return branch in Figure 2). The main objective of these feedback sessions is exchange of information between the company employees and the researchers, which is used for identifying the next steps in the assessment process and for refining the process improvement proposals. In addition, this exchange of information enables organizational learning in the company, increases understanding of the current practice with positive effect on overall business performance of the company (Dyba, Dingsoyr, & Moe, 2004; Hattie, & Timperley, 2007). The sessions are organized after analyzing collected data, which is usually implemented after identification of additional requirements during the previous session. The assessment is finished when the company management is satisfied with the proposed improvements.

CASE STUDY

The study was organized in a local software company in Serbia with 7 employees, which can be classified as a micro enterprise according to European Commission for Enterprise and industry publications (European Commission, 2015). The company develops business software solutions for indigenous companies in Serbia. For over 20 years in software industry, the company developed over 50 software applications for over 100 clients in Serbia.

Analysis of 2293 tasks completed in the company for the period of 18 months revealed that 2036 tasks are software maintenance tasks, which is 88.79% of all tasks (Stojanov, Stojanov, Dobrilovic, & Petrov, 2017; Stojanov, Stojanov, & Dobirlovic, 2018). This analysis indicates the importance of software maintenance practice for the overall business performance of the company, and justified initiation of a process assessment and improvement project focused on software maintenance processes in the company.

The project was organized as a joint endeavor of the company employees and the researches from Technical faculty ”Mihajlo Pupin” in Zrenjanin, Serbia. The research objective of the project was the assessment of software maintenance practice and identification of potential improvements that could be implemented in the company. For that purpose, a lightweight inductive method for process assessment was designed and implemented in the company, which is outlined in the following subsections.

Software maintenance process

A software maintenance process is started by receiving a maintenance request (MR) from a user. After receiving the MR, there are two possible paths for processing it, as it is presented in Figure 3. The first path is for the regular MRs and involves several typical steps from MR triage to a programmer to implementation of tasks needed to solve the MR. The second path is for urgent MRs that need to be solved as quickly as it is possible due to their criticality for business performance of user’s organization. This urgent path is concerned with immediate solving a problem, and later thinking about other organizational issues in the maintenance process.

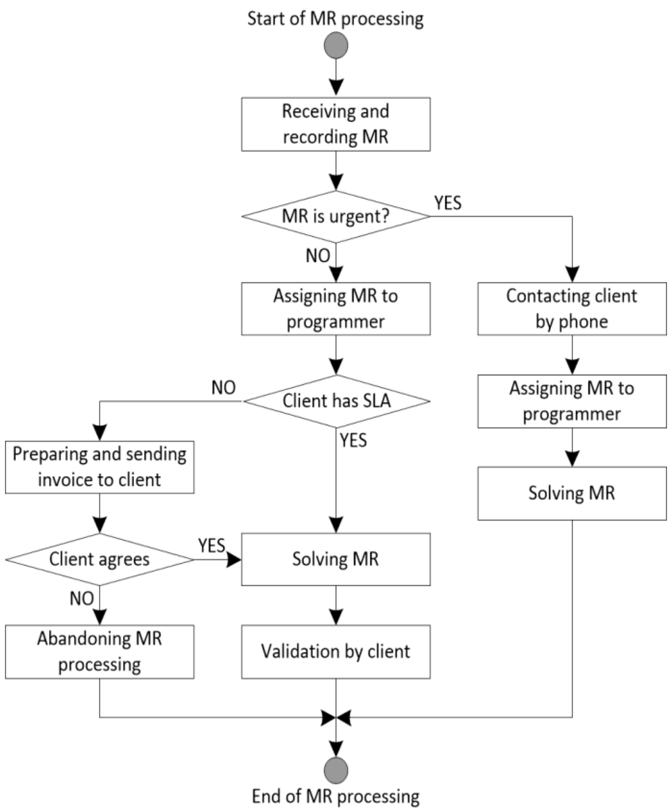

Figure 3: Software maintenance process implemented in the company

Standard processing of a MR starts with receiving and recording it into the internal repository of requests and tasks in the company. After that, a programmer to whom the MR is assigned checks if the client has a Service Level Agreement (SLA) for maintenance services and if there is no SLA the programmer prepares an invoice for maintenance service. If the client agrees with invoice, the MR is solved by the programmer. If the client does not agree, MR processing is stopped without completing required activities.

Implementation in the micro software company

The method LIMPAF[2] was implemented in a micro software company as a segment of the SPI initiative aimed at improving software maintenance practice in the company. The method design and implementation were proposed by the first author of this article, who is the leading researcher in the SPI project, and the company manager. The implementation lasted for 6 months.

Due to the high level of the company employees' engagement in everyday activities, all assessment activities were planned in a way that requires their minimal participation. In addition, all employees were informed in advance so that they have enough time to align it with their regular tasks in the company. The following issues were considered for successful implementation of the method:

- All assessment activities do not bring significant burdens on the employees. The employees participated in carefully planned and announced activities. These activities are: interviews, practice observation, extraction of quantitative data from the local repository of tasks in the company, participation in the feedback sessions, data analysis and prioritization of the proposed improvements.
- Data analysis activities will be performed by the researchers, who will consult with the employees for each identified problem. The feedback sessions helps in discussing the results of data analysis, which lead to better understanding of the practice and more reliable results.
- All potential improvements should be discussed with the company management and the most relevant employees. For each feedback session the employees that are the most concerned with the processes in the company will be selected, which ensures that the right experts will be included in prioritizing potential improvements based on the selection of the most valuable criteria.
- The researchers have access to all necessary resources in the company, which is necessary for implementing all assessment activities.

The researchers were included in the data analysis based on their expertise in specific data analysis techniques, while the company employees were included based on their importance for the currently inquired segment of the practice and the state of the research. The following roles were defined:

- *Assessment project leader*. This role is assigned to the company manager because all assessment activities should be aligned with the company business objectives and this role should ensure access to all relevant resources in the company. Project leader participated in the method design, planning activities and discussion of the results (improvement proposals).
- *Leading researcher*. This role is assigned to the first author of this article, who is responsible for the method design and implementation, all planning activities, qualitative data analysis, and selection of relevant researchers for specific quantitative data analysis.
- *Employees in the company*. They participated in several activities related to collecting and analyzing data. The employees served as the source of data through interviews and practice observation activities, assisted in extracting the most relevant quantitative data, and participated in all discussions of the research results. This ensures identification of the most relevant improvements for the current practice.
- *Researchers from university*. Since data analysis includes different quantitative methods, the researchers from university participated in these activities based on their expertise.

Data collection and analysis activities were based on qualitative and quantitative methods because of the variety of the data sources used in the company. Mixing different data sources assumes use of different methods for collecting and analyzing data, which ensures triangulation that increases the validity and usability of the research findings. Methods for collecting and analyzing data are presented in Figure 4.

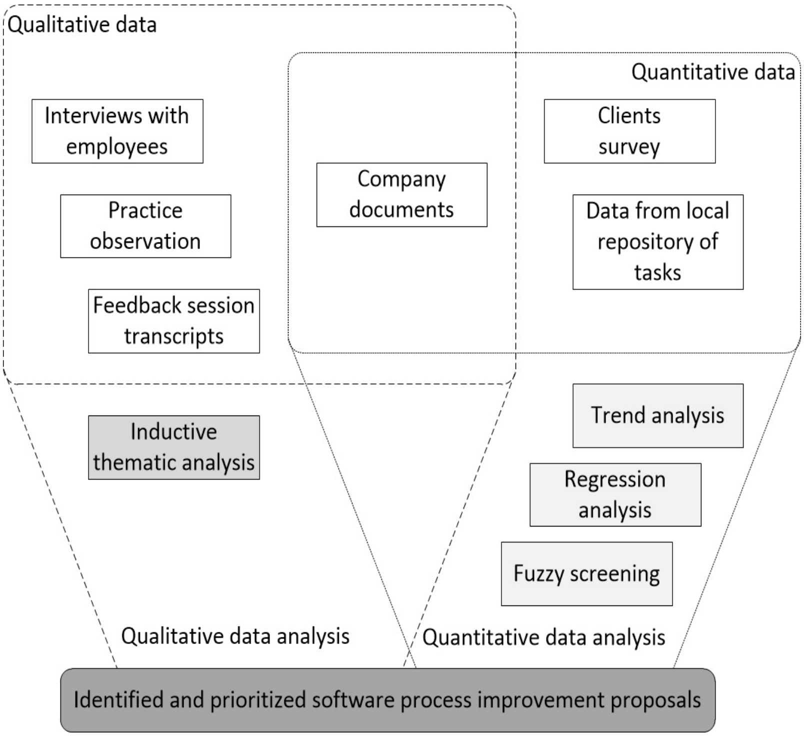

Figure 4: Methods for collecting and analyzing data used in LIMPAF[2]

The following data collecting activities were performed: (1) semi-structured interview with the company manager who has over 20 years of industrial experience, (2) collecting relevant company documents about the company internal organization, (3) semi-structured interview with two senior programmers, (4) the first cycle of data extraction from the local repository of tasks, (5) practice observation that includes three programmers and technical secretary, (6) surveying clients, (7) semi-structured interviews with two junior programmers, (8) the second cycle of data extraction from the local repository of tasks, and (9) the final semi-structured interview with the company manager. After each data collecting activity, the most suitable data analysis method was used (see Figure 4).

Data analysis activities includes analyzing trends in quantitative data extracted from the repository of the tasks (Stojanov, Dobrilovic, & Stojanov, 2013; Stojanov, Stojanov, Dobrilovic, & Petrov, 2017), analyzing relations between different aspects of maintenance processes and organizational issues by using regression analysis (Stojanov, Dobrilovic, Stojanov, & Jevtic, 2013), and ranking maintenance processes by using fuzzy screening method (Stojanov, Brtka, & Dobrilovic, 2014). Data analysis findings and outcomes were discussed in the feedback sessions (Stojanov, & Dobrilovic, 2017), where all improvement proposals were examined and ranked based on their relevance for the maintenance practice.

Feedback sessions, or information exchange sessions, were organized in the company, in the meeting room, so that all participants were sitting at the same table. The audio track of each session was recorded, which ensures that the discussion can be analyzed in detail later. Each session was prepared and moderated by the leading researcher, who invited all other session participants based on the current state of the research. For example, if the objective of the session was to analyze practice observation, all programmers whose work had been observed were invited to participate in the session and to assist in analyzing the notes from the observations. A total of 21 sessions were conducted, after which the set of improvement proposals was identified.

Study findings: Improvement proposals

Improvement proposals were identified by using inductive thematic analysis for analyzing the transcripts of the feedback session in which the proposals were discussed. Inductive thematic analysis assumes analysis of raw unstructured text to identify meaningful themes, by implementing analysis steps proposed by Braun and Clarke

(2006). The following maintenance process improvement proposals were identified:

- *Optimization of the time for processing maintenance user requests due to the triage procedure and the acceptance of the request for implementation*. This improvement implies a more precise recording of time intervals in the processing of requests, which can be implemented through appropriate changes in the software application for tracking user requests and associated tasks.
- *Optimization of maintenance tasks scheduling in the company based on the record of the consumption of working hours per task*. This improvement enables optimization of programmers' workload in the company, more efficient scheduling of clients' requests and more reliable tracking of costs for implementing maintenance tasks.
- *Creating a web based application for collecting maintenance requests from clients*. This web application will allow clients to submit maintenance requests which will be directly recorded in the internal application for tracking maintenance requests and associated tasks. This improvement will make submission of maintenance requests more reliable and easier.
- *Creating a software solution that would perform previews relevant for processing user maintenance requests*. This previews of data related to processing maintenance requests will be based on statistical analysis of all data in the repository of tasks. This improvement will enable analysis and problem detection in maintenance processes, which will be useful in making business decisions in the company. The solution assumes development of a new software which will be integrated with existing software for tracking maintenance requests and tasks.

All identified proposals were prioritized by using fuzzy screening method (Yager, 1993), which enables ranking of all alternatives (improvement proposals) based on the most relevant ranking criteria for the company. The prioritization was done by three senior programmers from the company and the leading researcher who has over 15 years experience of working with small software companies. Ranking criteria relate to the business strategy of the company, complexity of a technical solution that should be implemented, and how critical is proposed improvement for the maintenance practice in the company.

Formal ranking of the improvement proposals revealed that the highest priority for implementation in the company has the first improvement proposal: *Optimization of the time for processing maintenance user requests due to the triage rocedure and the acceptance of the request for implementation*. This improvement was implemented in the company and documented as a technical solution.

BENEFITS AND IMPLICATIONS

The following benefits for the company can be perceived from this study. The first one is detailed assessment of the maintenance practice and identification of possible improvements that can positively impact the overall business performance. Although only one improvement proposal was implemented, other proposals could be implemented after observing the use of the implemented one. The second benefit is an insight into organization of a research study aimed at practice assessment and improvement, which can be used as a model for studies focused on assessing other segments of the practice in the company. The third benefit relates to the increased sense of the personal importance in the company since all employees actively participated in research activities, which positively affect motivation and satisfaction of the employees.

Small software companies can find guidelines how to design and implement lightweight assessment of their practice by using proven research methods. In addition, they can see how to organize a research study with the assistance of the researchers from university.

The researchers can draw the following lessons from this research: (1) how to organize a study by using inductive qualitative research methods, as well as how to supplement the findings of the research with results from the analysis of quantitative data, (2) how to organize process assessment activities within larger ad more complex process improvement projects, and (3) how to design a research study with active participation of the staff within researched organization.

CONSTRAINTS AND VALIDITY

The validity and rigor of the presented empirical study is based on ensuring that trustworthiness criteria, such as credibility and transferability are considered during the study design and implementation (Morse et al., 2002; Schwandt, Lincoln, & Guba, 2007). The credibility, or the internal validity of the study was ensured through careful use of inductive thematic analysis method and other quantitative data analysis methods, together with detailed presentation of the assessment method and the context of the study. Triangulation of various data sources and data analysis methods (Miller, 2008; Moran-Ellis et al., 2006), and active participation of all employees in the research process positively contribute to the validity of the study design and findings.

The main constraint of the study that affect the trustworthiness is transferability (generalizability) of the research findings. However, the aim of this study is to present a guidelines how to organize a lightweight inductive study aimed at assessing everyday practice, which is tailored to specific needs and constraints of small companies. Therefore, transferability relates to use and adjustment of the methods rather than use of the study findings.

CONCLUSIONS

Software process assessment is essential activity within improvement projects, allowing identification of issues that need to be improved. However, micro software companies do not have time, human and other resources to independently organize assessment and improvement projects, but rather do that in cooperation with the researchers from university or independent consultants. These companies need tailored and lightweight assessment methods due to their specific organization and daily engagement of the employees. This article presents a lightweight inductive assessment method based on active participation of the employees and frequent feedback. The method was implemented in an indigenous micro software company in order to assess maintenance process that consumes majority of working activities. Four potential improvements were identified, while the best ranked one is implemented in the practice.

The main results of this study are identified process assessments that are aligned with the company internal organization and longterm business strategy. This is ensured through full engagement of the company employees in all phases of the study implementation. In addition, the ranking of the potential improvements was done by one researcher and three most experienced programmers, which assures the the most relevant improvement for the company was implemented.

The study has the following contributions. The first contribution is presentation of the new method for process assessment (LIMPAF^2), which is suitable for small organizations and includes frequent feedback during the assessment process. The method is described in details, while the several places for adjusting the method to other small organizations are clearly stated. The next contribution is a clear guideline for organizing process assesment study in small organizations as a joint work of the staff and the researchers from university. This contribution is very important since small organizations do not have resources and knowledge of research methods for assessing and improving their practice. The last contribution is improved satisfaction of the company employees and management because of their active involvement in the practice assessment and improvement, which is important for the sense of belonging to the organization and contributing to its progress.

Further research will be directed towards monitoring implementation of the first implemented improvement, and drawing lessons for further improvement activities. In addition, implementation of the presented lightweight assessment method in other small software companies will provide evidence about its usefulness, which is also potential research direction.

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LAGANA INDUKTIVNA METODA ZA PROCENJIVANJE PROCESA BAZIRANA NA ČESTOJ RAZMENI INFORMACIJA: STUDIJA U MIKRO SOFTVERSKOM PREDUZEĆU

Procenjivanje softverskih procesa je najvažnija faza u projektima poboljšavanja procesa pošto omogućuje identifikaciju svih kritičnih stavki u procesima koje treba poboljšati. Mala i mikro softverska preduzeća imaju brojna ograničenja u organizaciji koja ih onemogućavaju da primene standarde i vodiče dobre prakse za procenjivanje procesa. Zbog toga ova preduzeća primenjuju lagane metode za procenjivanje koje mogu prilagoditi svojim potrebama. Ovaj članak prikazuje laganu induktivnu metodu za procenjivanje procesa. Metoda se može prilagoditi potrebama malih preduzeća. Metoda je bazirana na aktivnom učešću zaposlenih u preduzeću i podrazumeva čestu razmenu informacija tokom radnih sastanaka koji se organizuju u preduzeću. Metoda je implementirana u mikro softverskom preduzeću u Srbiji sa ciljem procenjivanje procesa održavanja softvera. Identifikovana su četiri potencijalna poboljšanja procesa održavanja softvera, a najbolje ocenjeno poboljšanje je realizovano u preduzeću. Koristi za preduzeće, kao i implikacije za praktičare iz industrije i istraživače su takođe diskutovani.

Ključne reči: Procenjivanje procesa; Poboljšavanje procesa; Povratne informacije; Održavanje softvera; Mikro softversko preduzeće.