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RE-ENGINEERING TOOLS REQUIREMENT RE-ENGINEERING PROCESS MODEL ON MARKET USE CASES (RREPM)

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ABSTRACT

Research conclusion in requirements Reengineering (RE) reports that software organizations still resist in launching processes that lead to appropriate requirements behavior. This leads to the acknowledgement that it is not common that the agreement of good requirements engineering practiced by any software industry.

Even though some proposal have been prepared to stretch the use of good performance of adapted RE, the area of market-driven requirements Reengineering (MDRRE) still be deficient in an involvement in that trend. MDRRE is differentiating by strong market and strategic point of reference, which shows the disparity with the client/improvement institute liaison of custom-made RE. This deception makes quite a few confronts to software product organizations, such as the need for support development behavior with managerial and product approaches.

In an effort to aid these organizations to comprehend the benefits of MDRRE, the Market-Driven Requirements Reengineering Process Model (RREPM) is developed. RREPM is an anthology of good practices in Market driven requirements and an assessment contrivance for organizations to get a depiction of the current state of their MDRE performance. The evaluation proposes to disclose the problem areas of organization's requirements process, which can be worked upon by initiating good practices portrait in the model.

The REPM has been shown to be useful for industry practitioners. A unanimous opinion has been found as to the good coverage it provides of concerns correlated to MDRE, and as to its usefulness for driving improvement efforts in requirements engineering.

INTRODUCTION:

Research in Software Engineering, and especially in Requirements Engineering, is not short of reports of problems faced by industry when it comes to the outcome of software development activities. Often, the root of these problems boils down to deficiencies in the process of handling software requirements [1,2,3].

The area of RE is also used in a market-driven environment, in which case development organizations produce software to a market rather than a specific customer [4]. This area is known as market-driven requirements engineering (MDRE). In order to lessen the gap between academia and industry, some initiatives have been taken towards process improvement in requirements re-engineering. These came to fill the gap left by software process improvements frameworks, like CMM and CMMI, which focused on a broader perspective and only covered requirements engineering to a limited extent [5].

The initiatives for requirements engineering mentioned above are, namely, the Requirements Engineering Good Practice Guide (REGPG) [6], and the Requirements Engineering Process Maturity Model (REPM) [7]. These initiatives consist of models that contain a collection of good practices in requirements engineering, which can serve as guidance for improvement.

Some of these challenges have been addressed by research in concentrated efforts to solve specific issues, such as requirements prioritization [9], release planning [8, 10], and requirements elicitation [11], to name a few examples.

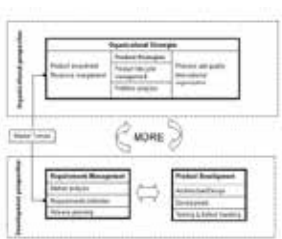

Figure: 1 different perspective in software development

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RREPM - AN OVERVIEW:

Figure 1 above depicted the different perspectives that exist in software product development. In addition, the discussion in previous section referred to the challenges faced by market-driven organizations, and how requirements engineering can help overcoming them. Based on the idea that a good process to handle requirements is at the core of successful software product development, the creation of the RREPM took place by considering the applicability of requirements practices to a market-driven situation.

This was done by first identifying what the main process areas are of interest in market-driven software development, and where requirements engineering could come to help. The analysis of the characteristics of market-driven software development led to the identification of the following process areas:

ORGANIZATIONAL SUPPORT:

Software product development has a strong market focus, which demands organizations to have an outward look towards markets, competitors, as well as opportunities and threats that may arise from those. On the other hand, an inward look towards the organization itself is also important, for example to foster innovative thinking. Ideas of new products or new product features that are created within the organization can potentially become a success if released in the market place. In addition, roles and responsibilities to conduct activities related to marketing, product management, and requirements engineering are also relevant to ensure that ideas for product features get translated in actual software products by development personnel. These organizational aspects are needed to support the execution of a requirements process. Therefore, the process area Organizational Support has been identified for the RREPM. It contains several practices that software organizations can perform in order to give a strong market and strategic orientation to their businesses. In addition, this process area is also concerned with practices needed to setup the foundation for the development of a requirements process.

RELEASE PLANNING:
Software product development is characterized by usually short time-to-market, which often clashes with resource availability needed to implement desired product features. In addition, the process of deciding which features get implemented and when can be difficult to perform given the sometimes conflicting interests of different stakeholders. This is where the process area of Release Planning of the RREPM comes to help. This process area is dedicated to provide organizations with practices on how to prioritize requirements, which factors to consider when selecting them, and how to improve requirements selection process.

REQUIREMENTS MANAGEMENT:
Market-driven organizations are usually faced with high requirements influx, which can come from many different sources. These requirements are not only of interest for developers who will implement them, but also for many other roles. For example, a product manager will be interested in a high level product feature when deciding whether it should be selected for implementation in a release. On the other hand, developers will need more details about the functionalities that compose such feature in order to develop them properly. Therefore, the way requirements are specified will define their audience. [6]

Requirements management takes care of that: the procedures to specify requirements so that they are understandable by different audiences. In addition, it is also concerned with controlling changes to requirements, controlling their versions, and providing proper tool support for managing requirements attributes, their lifecycle, as well as the relationships between them.

REQUIREMENTS ELICITATION:
In a market-driven situation, potential customers can be as few as a dozen of known key customers, or as many as in a mass market. Therefore, finding out which requirements should be implemented in a certain product is challenging. The Requirements Elicitation process area in the RREPM contains good practices that can be used to identify what requirements sources can be considered, and techniques for eliciting requirements from them.

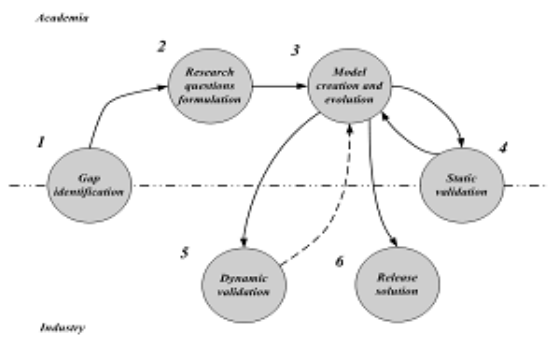
REQUIREMENTS ANALYSIS:
As requirements are elicited, they can be specified in varied levels of detail and quality. Some requirements may be too poorly described that they can't be let go further without fixing problems in them. Other requirements may look good at a first glance, but may hide ambiguity that can cause misinterpretations later. Requirements influx may also be high; in which case the amount of requirements received is more than what can be analyzed. Requirements Analysis is the process area of the RREPM that is concerned with the issues above. It contains good practices to aid organizations in assuring the quality of their requirements, and to also help managing a high requirements influx.

The organizational perspective is the one which defines the organizational and product strategies, whereas development perspective comprises the engineering view, with requirements management and product development activities (e.g. architectural design, development, testing and defect handling) [9]. The organizational strategies are supported by product investment and resource management, and are concerned with the efficiency of processes and quality of products, product lifecycle management, portfolio analysis, etc; it is also the one from which product strategies are derived [9]. This gap is related to the development of a model for assessing practices in market-driven requirements engineering, and to provide market-driven organizations with a collection of good practices which they can use to improve their requirements engineering processes. This model has been named Market-Driven Requirements Re-Engineering Process Model (MDRREPM).

With that in mind, the following research questions have been created to guide the research towards the creation of the model above.

1) What are the main process areas in MDRE and what can be considered good practices in them?
2) How can market-driven software organizations obtain an assessment of their RE practices?
3) How can the assessment be made quick, cost-effective, and helpful to these organizations?
4) Once presented with assessment results, how can market-driven software organizations find ways to improve upon their weaknesses in requirements engineering?

Research Method
The research method used for this thesis is outlined below.



The reason of focusing only on the literature view for identifying practices is that, as already verified, a good part of the research in MDRE has been done in close collaboration between industry and academia (e.g. [5, 6, 7, 8, 9, 12, 13, 16, 17, 18, 19, 20]). Therefore, the idea was to build upon this knowledge, thus saving time for the model development. In any case, the validation of the model through the static and dynamic steps were considered as part of the research approach in order to assure the model was of good quality and useful before its release.

THE DIFFERENT PERSPECTIVES IN SOFTWARE PRODUCT DEVELOPMENT
Software product development is characterized by the presence of different perspectives, mostly due to internal and external stakeholders present in the development organization. It is a complex environment where interests from different parties play a role in decision making, and where a good interaction between them becomes crucial for maximum business benefit.

RREPM as the Bridge between Different Perspectives

Previously, an introduction to the different perspectives in software product development was presented. In that discussion, communication across the different perspectives was commented to be important in order to have a positive outcome, having them all working together towards common goals.

The RREPM was designed in order to foster the above. That is, the RREPM contains suggestions of good practices that can be implemented by software organizations that can bring the different perspectives together through the use of an established requirements process.

The Picture below shows how the RREPM intends to bridge the distances between all different perspectives. The way this is achieved is explained after the figure.

Figure: 4 RREPM for Market Use Cases

Organizational Support intends to bring upper management, board of directors, product management, and marketing together by spreading a strategic mindset throughout the organization. This process area focuses on strategic planning as a way to align activities performed in other areas of the organization under a common framework set out by organizational and product strategies.

Requirements Management lays out the foundation upon which the requirements process will be executed. This process area does that by suggesting practices on how to specify requirements and managing them. It provides the structure needed for issuing requirements, accessing them for purposes such as analysis, prioritization and selection for implementation in different releases. This in turn is of interest for development, project management, and testing.

Release Planning, in turn, helps bridging the distance between perspectives by defining which features will be implemented at what point in time, and who will get them. This is of interest for key customers, product and project management, marketing, development and testing.

Requirements Elicitation has a crucial role of finding out what requirements can be considered for implementation. It therefore sets out the stage where all subsequent requirements and development activities will take place.

Finally, *Requirements Analysis* helps by handling requirements overload and by assuring requirements are of good quality. In this way it helps ensuring the work carried out, and also expected by many stakeholders can be done by relying on requirements as the common denominator among them.

CAN THE RREPM HELP YOUR COMPANY?

The RREPM was developed by having software product organizations in mind. Its goal was to gather a collection of good practices in market-driven requirements engineering in a single place. Moreover, the goal was also to structure such practices in a recommended order of implementation, by placing them in different levels and indicating, for each practice, which pre-requisite practices the organization should strive to implement first. However, given the large variety of businesses in software product development, it is very difficult, if not impossible, to come up with a model that can contemplate the needs of all. The RREPM, therefore, does not attempt to be a massive model that would try to fit every possible case. Rather, it has been conceived having in mind the most common needs that software product organizations face when handling requirements for their products. For example, the needs for market orientation, strategic thinking, and processes to elicit, analyze, deliver, and manage software requirements.

Therefore, the aim of the RREPM is to help organizations to realize the scope of the activities involved when tackling market-driven software product development. By suggesting a collection of requirements practices divided according to process areas and levels, the model aims to provide guidance to organizations so that they can improve their way of handling requirements. [12]

The model helps organizations by first providing a way to make an assessment of its current practices in MDRE against the practices in the model. Once assessment results are collected, they can be visualized in a graphical representation, which can then be used to point out which practices have not yet been implemented. It is expected that the practices in the RREPM will help organizations to be aware of areas they may be lacking expertise, and also point out which ones they are in most need for improvement. Revealing problem areas during the assessment is the first step towards process improvement, which can be tackled by considering practices that have not yet been implemented.

OBSERVATIONS:

A graph plotting the results of a fictitious assessment is shown in the figure below to exemplify how the result presentation works.

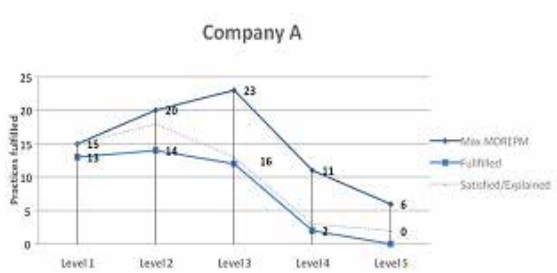


Figure 5 Example of Assessment Result in MDREPM

The figure shows the overall practice fulfillment by level of a fictitious company. The Max RREPM series represents the maximum number of practices that can be fulfilled in a certain level. The Fulfilled series represents the number of practices answered with Yes during the assessment. Finally, the Satisfied/Explained

series is a sum of Fulfilled practices with Satisfied/Explained practices. That series then represents the real number of practices fulfilled in a certain level, some of which are fulfilled because they are not applicable (Satisfied/Explained). The lower the area between Satisfied/Explained and Fulfilled curves, the higher is the model usefulness and the lower is the model lag, and vice-versa.

Conclusion:

RREPM was motivated by the many challenges organizations face when developing software in a market-driven environment. In addition, it was motivated by the lack of an initiative in the field of market-driven requirements engineering towards the development of a model that could gather research findings in ways to make them easily accessible by industry practitioners.

RREPM achieves that by offering organizations an assessment tool which can reveal problem areas of their requirements process in a quick and cost-effective way. Moreover, the model provides a graphical representation of assessment results which can pinpoint weak areas in a quick glance. Organizations can then refer to the collection of good practices of MDREPM and find guidance through them towards an improved requirements process.

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