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ScienceDirect

Procedia CIRP 50 (2016) 14 – 19

www.elsevier.com/locate/procedia

26th CIRP Design Conference

Iteration-based Performance Measurement in the Fuzzy Front End of PDPs

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Abstract

Iterations are an inherent phenomenon in product development processes (PDPs), especially in its fuzzy front end (FFE), and a crucial concept in coached ideation workshops. Small- and Medium-sized Enterprises (SMEs) perceive such workshops as promising means for developing new products and enhancing their innovation capability. This raises the research questions of (1) "how to measure the performance of PDPs in its FFE?" and (2) "Which role do iterations play for the performance measurement of PDPs in its FFE?" Based on expert-interviews after each iteration in 14 workshops, we compare the approaches of (1) statement coding and (2) direct ratings according to a reflection guideline. By correlating the data with the workshop outcome, we identify the guideline as powerful means for quantifying the PDP performance in its FFE.

Peer-review under responsibility of the organizing committee of the 26th CIRP Design Conference

Keywords: SMEs; Innovation Management; Ideation Workshop; Performance Measurement; Iterations; PDP; FFE.

1. Introduction

Product development processes (PDPs) are a crucial part within innovation management, and thus, challenges within PDPs can have a negative effect on the innovation capability of companies. While iterations are an inherent phenomenon in PDPs, they occur extremely often during the early phases of PDPs which are characterized by uncertainty, so that they are called the fuzzy front end (FFE). However, already in the early phases of PDPs, important decisions have to be taken regarding the forthcoming product properties and characteristics. Cooper [1] states, that the stage-gate approach is a common standard to develop products. However, if at later stages/gates of the PDP turns out that these early decisions were mistaken, so called cross-gate iterations occur. While large companies with sound financial capacity may increase their PDP resources after cross-gate iterations, for small and medium-sized enterprises (SMEs) which lack resources, the consequences of such iterations can be existence-threatening. Moreover, product-life-cycles are continuously shortening, and the time-to-market for new products is shortening as well [2]. Thus, these SMEs need means to ensure that they are 'on the right track' – i.e. performing well – during the FFE of PDPs. Algere et al [3] identified two key dimensions of product innovation performance: efficacy and efficiency.

Besides a broad body of literature about the boon and bane of iterations in PDPs, there is literature regarding performance measurement and management in general, as well as more specifically to performance measurement in PDPs. However, means regarding the performance measurement of PDPs in their FFE are still lacking. Thus, our research questions are: (1) *How to measure the performance of PDPs in its FFE?,* and (2) *Which role do iterations play for the performance measurement of PDPs in its FFE?* By addressing these questions, we aim at identifying adequate performance measures in the FFE of PDPs, and to develop means for the performance evaluation of iterations, which are also applicable for practitioners in SMEs. The scope of our study is on the FFE of PDPs of SMEs which we observe and analyze in ideation workshops. Thus, we chose an ideation space as research environment.

The remainder of the paper is structured in five sections. The next section reviews literature on performance measurements in SMEs, their challenges in PDPs, especially with iterations, and performance measurements related to PDPs. Section 3 describes the research design, while Section 4 presents the results. In Section 5 we discuss these results and draw our conclusions in Section 6.

Peer-review under responsibility of the organizing committee of the 26th CIRP Design Conference
doi:10.1016/j.procir.2016.04.183

2. Background and related literature

We review literature about performance measurement and PDPs of SMEs, regarding iterations and performance measurement in these PDPs, and highlight the performance model E2.

2.1. Performance measurement in SMEs

Sharam et al [4] state that companies acknowledge the necessity to monitor and understand firm performance, especially in a continuously changing environment. Thus, measurement has been recognized as an important element for the improvement of business performance. A performance measurement system (PMS) is a system that enables support of decision-making processes by gathering and analyzing information [5]. Taticchi et al [6] revealed with their literature review a certain maturity of knowledge regarding large companies and a significant lack regarding SMEs [7].

However, Terziovski [8] researched innovation practices and their performance implications in SMEs, and find that SMEs' performance is likely to improve if they mirror large companies with respect to formal strategy and structure, and if they recognize that strategy and innovation culture are closely aligned throughout the innovation process. Sousa & Aspinwall [9] state that a PMS has to contribute to and should be integrated with other management objectives. Furthermore, the benefits of applying such a systems should justify its cost. Ates et al [10] found that SMEs seem to be more focused on internal and short-term planning, and neglect long-term planning. Their main challenges for applying PMS effectively lies in an appropriate and balanced use of strategic and operational practices and measures.

Regarding available models and tools, Bahri et al [11] present for instance the "Economic Value Added" for SME performance management that should be used in conjunction with a list of business practices that have an impact on the company's results. Cocca & Alberti [12] establish a framework to assess PMSs in SMEs. Their tool proposes codified best practices and makes them accessible for SMEs in an easy way.

2.2. Challenges in PDPs of SMEs

A recent study [13] elucidated 30 challenges in PDPs of SMEs, aggregated in the themes of iteration, decision making, and stakeholder involvement. In their sample, about 70% of the SMEs applied the stage gate process. Dealing with uncertainty, as well as the application of KPIs (due to a lack of performance measures) is challenging for the SMEs, even though they are striving for continuous improvements. Moreover, process setbacks and change propagation (e.g. due to cross gate iterations) are challenging for them.

Also Millward & Lewis [14] did research about barriers to successful new product development (NPD) within SMEs, and identified three managerial issues that influence NPD: (1) a dominant manager/owner, (2) a focus on time and costs rather a broader scope with additional key factors, and (3) a failure of understanding the importance of product design.

2.3. Boon and bane of iterations in PDPs

Ballard [15] and Le et al [16] describe positive as well as negative iterations in design, whereas design can be seen as the processing of knowledge [17]. According to Unger & Eppinger [18], "PDPs manage risk partially through iterations, which are controlled, feedback-based redesigns." While minor changes of product parts may lead to small iterations, large iterations can occur if external influences lead to changes of the overall design. In this context, Meboldt et al [19] and Unger&Eppinger [18] distinguish in-stage and cross-gate iterations. Especially the latter ones cause problems in reference to a previously announced market launch. This reflects a management perspective on iterations. However, there is also an engineering design perspective on iterations [20]. Iterations can also be perceived as learning cycles with the opportunity to improve the product's quality. Thus, knowledge increases while going through iterations. For instance, Wynn [21] identifies rework, exploration, convergence, negotiation, repetition, and refinement as different but non-orthogonal perspectives on iteration. In this context, early prototyping and testing seem promising approaches to discover the so-called 'unknown unknowns' [22,23] as early as possible, in order to avoid costly pitfalls.

To summarize "Iteration is often recognized as a major source of increased PD lead-time and cost, a key driver of schedule risk, ad a source of major uncertainties in the commitment of resources. However, iteration, when planned and managed effectively, can overcome the uncertainties inherent in interdependent development activities and thus, improve and accelerate PD projects" [2]. Thus, iterations might be useful to measure PDP performance.

2.4. Performance measurement related to PDPs

Lazzarotti et al [24] state, R&D activities are increasingly risky and costly, and thus, to measure performance becomes critical. They identify several perspectives of performance e.g. financial, customer, innovation & learning, internal business, and alliances & networks. Moreover, they acknowledge that measurement of R&D performance is challenging, as levels of effort are not easily observable and success is uncertain due to uncontrollable influences. Moreover, the definition 'R&D performance' is usually loose and context dependent. Also Neely et al [25] found that PMSs is a topic which is often discussed but rarely defined.

However, Moultrie et al [26,27] describe a tool to evaluate design performance in SMEs. Their 'Design Audit Tool' captures good design, is based on process maturity principles, and targets explicitly design related activities in NPDs of SMEs. The tool enables a design team to evaluate their design process with a view to targeting improvements. It comprises a 'process audit' to identify improvement opportunities in the process, and a 'product audit' enabling perception of product characteristics to be assessed. "By first focusing on the tangible output of the design process – the product – practitioners are better able to understand the way in which design decisions influence product usability, desirability and producibility"[26].