The Digital Factory:  
A Reference Process Based  
Software Market Analysis  

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ABSTRACT  

Today, industrial enterprises are increasingly facing the need to achieve shorter lifecycles for their products,  
which at the same time are getting more and more complex. One approach to face this challenge is to introduce  
the Digital Factory. The Digital Factory is defined as an IT system capable of digitally planning, controlling  
and optimizing all resources and activities related to a product which are performed beginning with its develop-  
ment and ending in the order processing – prior to the start of the real production of the product. In this  
article a newly defined reference process for the Digital Factory is used as basis for a software classification  
schema. Using this schema the results of a software market analysis for the Digital Factory domain have  
been structured and interpreted from a process and functionality coverage point of view. With this approach,  
the authors were able to prove that the amount of software solutions available within this domain is huge.  
This generates a need for IT support within the software selection process for the Digital Factory domain.  
To achieve this, a first concept for a structured software selection process is introduced. The results of this  
article can be used as a basis for future research on this topic.  

Keywords:  Digital Factory, IT System, Market Analysis, Reference Process Model, Software Selection  

INTRODUCTION  

Product lifecycles in today’s industrial enterprises are getting shorter and shorter and are  
accompanied by a rising complexity of the manufactured products. These changing basic  
conditions require enterprises to enhance their planning efficiency as well as their planning  
quality. One approach to reach these goals is to introduce the Digital Factory. The Digital  
Factory is defined as an IT system capable of digitally planning, controlling and optimizing  
all resources and activities related to a product which are performed beginning with its develop-  
ment and ending in the order processing – prior to the start of the real production of the product  
(Himmler & Amberg, 2013a; VDI, 2008).  

Prior research on this topic has shown that an individual selection of the software solutions  
based on the companies’ requirements is a major success factor for the implementation of the Digital Factory(Graupner & Bierschenk, 2005). However, according to Himmler and Amberg  
(2013b) there are currently two main factors
which preclude such an individual selection of software solutions:

- Due to the heterogeneity of requirements, there is currently no single software solution available covering the complete set of functionality.
- Due to the complexity of the topic, there is an unmanageable number of different software solutions available on the market, each covering only a small subset of the Digital Factory.

In this article we will first introduce a reference process model for the Digital Factory. This model is then used to structure the results of a software market analysis, which has been performed within this domain based on a structured classification model. After that, the analysis results are evaluated from three different perspectives (process, functionality and supplier perspective). Finally a concept for a Digital Factory software recommendation tool is introduced which should be extended in future research in order to support the software selection process for the Digital Factory.

RELATED WORK

The term Digital Factory has emerged during the past two decades, and over this time a large number of definitions has been developed (Bracht & Masurat, 2005; Zäh & Schack, 2006). With regards to their contents, most of those definitions significantly differ from each other, leaving open a wide range of possible interpretations (Wenzel, Jessen, & Bernhard, 2005). According to Himmler and Amberg (2013b), those definitions can be classified into the three different categories: “Representation”, “Focus Factory Planning and Production Planning” and “Integration of Product Development”. The definitions categorized as “Representation” use the Digital Factory as a simple digital representation of a real factory in order to describe existing structures without offering any further planning capabilities (e.g. Aldinger, Rönnecke, Hummel, & Westkämper (2006)). On the other hand those authors defining the Digital Factory as “Focus Factory Planning and Production Planning” interpret it as a collection of digital tools and methods to perform an up-front planning and validation of the factory and its production (e.g. Cheutet, Lamouri, Paviot, & Derroisne, 2010; Ikeda & Yamazaki 2011; Jain, Choong, Aye, & Luo 2001). Some authors, whose definitions can be categorized as “Integration of Product Development” interpret the Digital Factory as an IT concept which offers methods and tools to digitally plan and control all activities in the context of product development, factory planning and production planning (e.g. Arndt, 2007; Himmler & Amberg, 2013b; VDI, 2008).

Even though there is a vast variety of different definitions and interpretations available, none of them provides any kind of process model for the Digital Factory. Such a process model could be applied by stakeholders who deal with this topic, and desire to get an overview and common understanding of the domain.

In addition to the lack of a common understanding of the term Digital Factory, there is also an increasing amount of software vendors available offering services within this domain (Bracht & Masurat, 2005). This leads to a large number of different software solutions (Bley, Fritz, & Zenner, 2006) and complicates the software selection process in context of the Digital Factory (Meier & Homuth, 2005). Yet at the same time an individual and requirements based selection of the software tools is crucial to a successful implementation of the Digital Factory (Dettmering, Reiter, & Naß, 2010; Schraft & Bierschenk, 2005).

DIGITAL FACTORY REFERENCE PROCESS MODEL

In this article we will introduce a new holistic reference process for the Digital Factory. This model can be applied by stakeholders and companies interested in topics within this domain.
Effective Integration of Reliable Routing Mechanism and Energy Efficient Node Placement Technique for Low Power IoT Networks
