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Procedure of modular Green Factory Planning to enhance collaboration and decision making

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Abstract

Planning resource and energy efficient factories is a challenge for present approaches because of the additional knowledge required and because of the high variety of energy efficient measures theoretically available; modularity as promising solution allows case-adaptability and focusing most relevant energy drivers during planning. Planning requires interdisciplinary collaboration and smooth decision making in these modules because different factory elements interact and information needs to be processed. This paper describes the composition and interconnection of Green Factory Planning modules focusing the assignment to planning experts and the management procedure to have higher impact on green performance. A use case shows how planning modules can help identify relevant information and key team members to let them collaboratively find solutions.

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1. Introduction

In faster changing economical and social environments planning becomes more challenging for almost every industrial company. This does not diminish but increase the importance of planning in production domain, as appears by the rising number of publications in the research field.

Topics like production efficiency, adaptability and flexibility of production systems as well as manufacturing information systems were seen as the core challenges in the last decade. More recently the cost and effects of energy consumption also became a focus in the industrial context [1], because of the increase in energy price and of the changes in the political and societal attention.

Starting with the reactive measures for the end use of products (i.e. recycling) the awareness for resource consumption moved into more proactive consideration within product design, production operation and also factory planning. This challenged existing principles and approaches and required new ways of thinking.

As other evolutionary step in production planning such as lean philosophy, the planning of energy and resource efficient factories poses challenges to planners. Knowledge, methods and tools are required in addition to the decade-long expertise built in industry and a huge variety of measures could be implemented to improve energy performance. This is complicated by economical boundaries every company decision is subject to.

Since full potential of production aspects like energy efficiency in operation are predetermined by the interaction of production system components (e.g. machines, technical building services), major invest-causing changes (like planning new building, modernization, re-planning) in production factories are the core of this research. For this research green factory planning is considered as a design process that takes product and location of the factory as defined inputs and guide through the decisions on processes, resources, material flow, layout, building and building services to come up with a detailed plan for a new or renewed green factory [2].

In this paper, ‘green’ is understood as the maximal generation of value under minimal effects (e.g. consumption, pollution) for the environment. This broad aim refers to resource and energy efficiency as well as to reduction of emissions etc. Important to mention is the restricting principle of contributing to economical success of a company to make the research applicable in industry. Green factories must be economically efficient while they are environmental conscious.

To properly address the challenge of green factory planning, a modular approach is proposed that supports planners to focus on most important aspects from green perspective, to consider relevant measures and information needed for the specific case. First, research and industrial challenges are defined. Then the procedure that guides experts involved in factory planning, on how to create a green factory is proposed and finally an application is shown to facilitate understanding.

2. State of research and research challenges

Factory planning can be seen as the realization of the factory elements represented in Fig. 1. For example, how production processes and technologies are selected in an early plan-

ning phase needs to consider the environmental legislation in the country, rather than requiring extensive investments in the disposal infrastructure to avoid natural damage and law violations later. The required and resulting information to perform activities for planning the factory elements need to be gathered, directed and processed appropriately in a consecutive procedure to ensure benefits for the green factory performance. Planning activities for a factory element are generally described as planning tasks (e.g. material flow planning, area dimensioning and layout planning for the factory layout). The term ‘procedure’ in this paper is defined as operational sequence that makes those planning tasks manageable and ensures a comprehensive execution by experts to be involved.

That representation helps to identify additional green information and the measures that can be taken into account during planning.

A variety of established tools and methods allow now to perform single tasks for planning of a factory element (e.g. Life Cycle Evaluation to calculate costs and environmental impact of products supports the selection of production equipment [3]). Also a lot of single technical measures (see Fig. 2) as well as best practice frameworks like ISO 14000 [4]

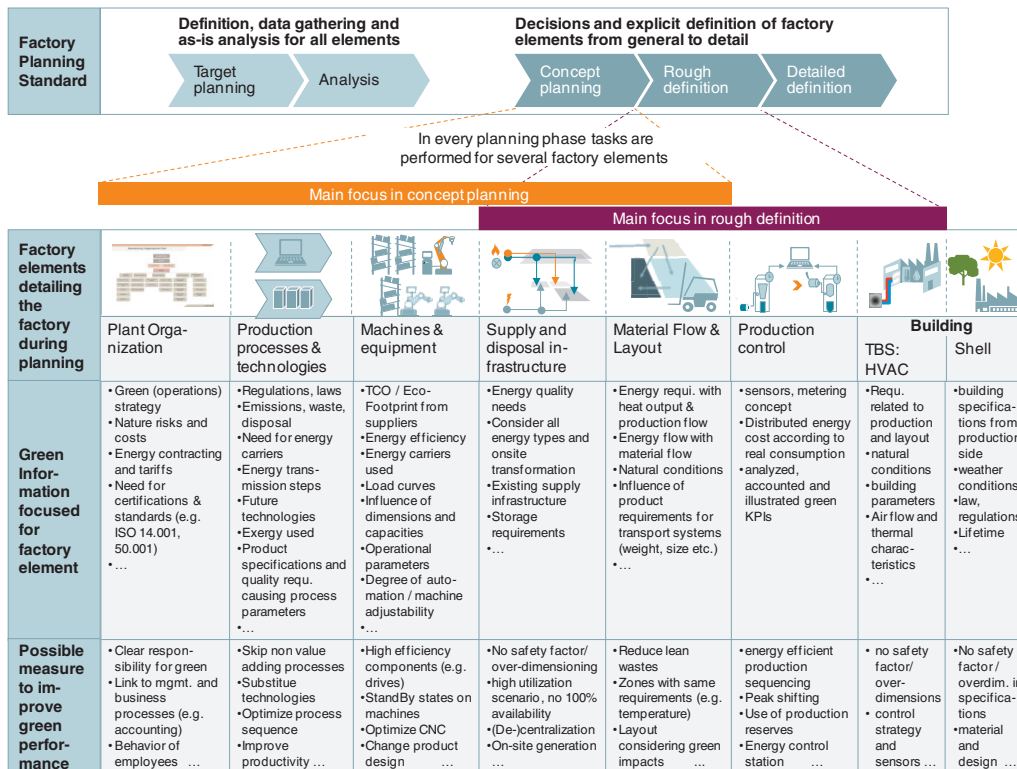


Fig. 1: Factory elements and green planning information changing existing planning standard

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