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Job Role Transformation Of Assembly Planners – A Case Study

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Abstract

In this contribution, a case study of a German machine and tool manufacturer is presented, depicting the requirements placed on assembly planners by disruptive product-related innovations. The case study initially outlines the current state of tasks ahead of the introduction of disruptive products, demonstrates how the new requirements were systematically identified, and illustrates how the new job role was shaped in terms of tasks and competences. This was done, in particular, by addressing the novel demands related to electronics, sensors, AI, software solutions, and associated planning aspects throughout the product development, line and workplace planning, series planning, and even in new concepts for the overhaul of products. Thus, the contribution shows on the example of the assembly planners, how job roles transform under challenging conditions and how this can be systematically identified and made usable for competence development.

Keywords

Digitalisation; Job roles; Assembly planner; Competence management; Competences

1. Introduction

Before a new product can go into series production, all production processes must be planned and the necessary work environment must be created [1, 2]. This is where the production planner comes in. They determine what is manufactured, how it is manufactured, with what it is manufactured, and in what way. This means that the focus of a production planner's work lies between the product development phase and final assembly. A planner must be very familiar with both the product and the production equipment, as well as the actual production processes [3, 4].

The efficient planning of production lines is therefore of central importance for production planners [5]. However, the role of the assembly planner in manufacturing companies has changed considerably in recent years. Driven by digitalization and the associated changes in production and new, highly digitally oriented products, the production planner today faces new challenges [6, 7]. Unfortunately, despite these new requirements, research on the specific challenges in terms of future work and work tasks of assembly planners under the influence of new disruptive product generations hardly exists. So, this contribution focuses on assembly planning for a new disruptive product in a German manufacturing company. The case study initially outlines the current state of tasks ahead of the introduction of a new disruptive product never be produced by the company before, that includes sensors, lasers, robotic functionalities, a new software architecture and autonomous mobility features. So, in this paper it will be demonstrated how the new requirements for assembly planners caused by the disruptive product were systematically identified, and illustrates how the new job role was shaped in terms of tasks and competences including a job role upskilling approach.

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The objective of the case study is to illustrate how a transformation path for an assembly planner in machine industry looks like under the impact of a new disruptive product with new features that revolutionize not only the different workplaces that have to be planned and reconfigured but also the material, tools and assembly and work instructions. As a result, the role of the assembly planner is enlarged in the product developing phase and in the factory planning phase.

2. The case study

The case study outlines the steps required to make the job role of the assembly planner fit for the new requirements of autonomously acting machines. The following steps have been taken in the case study:

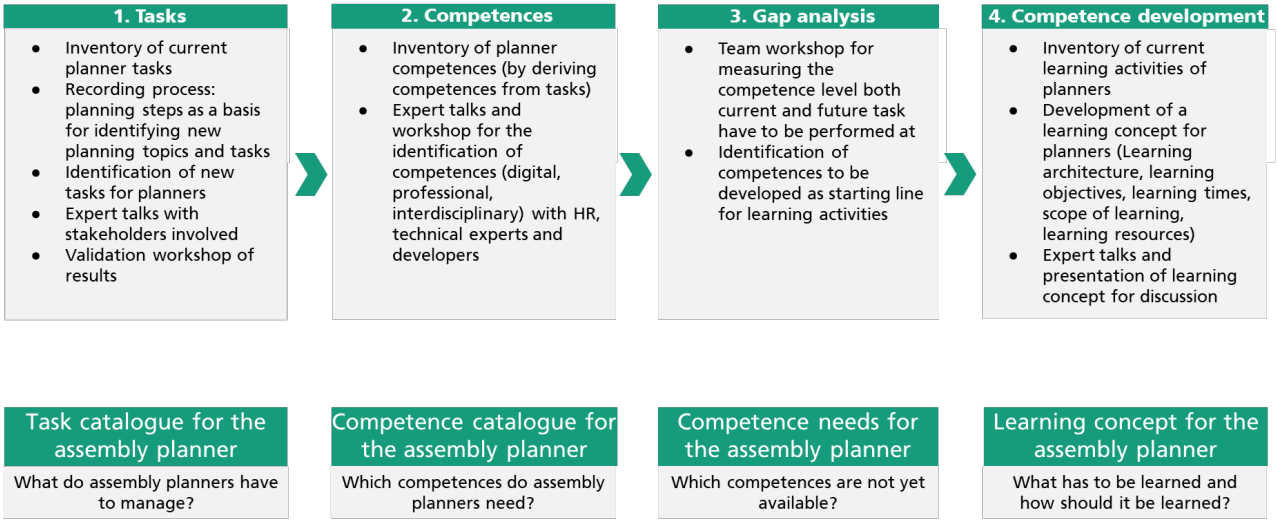

Figure 1: 4 step approach of the case study

- **Step 1:** The identification of new work tasks that includes the identification of new technologies present in the autonomously acting products that have not been encountered before or have been encountered differently (more sensors, different electronics, greatly changed IT hardware and software, and AI solutions).
- **Step 2:** The identification of new competences for assembly planners to cope with new work tasks
- **Step 3:** The assessment of competence gaps. Assessment of which of these technologies require new competences in which tasks of the planner in order to be able to carry out adequate holistic planning (taking into account product development, line and workplace planning, series planning, and new concepts for the general overhaul of products). This includes the presentation of the determination of a transformation plan specifying which competences need to be developed for the assembly planner in which tasks.
- **Step 4:** The competence development. Outlining the methodology used to select the design of learning modules, learning content, and learning paths as a basis for qualifying the assembly planners.

2.1 Step 1: The identification of new work tasks for assembly planners

In the first step of the case study, the changes in tasks and processes were examined, particularly in the context of the introduction of autonomous acting products for customers [8]. Based on a holistic understanding for factory planning, an inventory of the current tasks of the assembly planner was conducted [9, 10]. This included documenting the process steps based on conventional planning steps of assembly lines for the previously offered non-autonomous acting products. The aim is to create a comprehensive task catalogue for assembly planners, providing necessary insights into the current challenges and activities of assembly planners.

In the next step, together with R&D, assembly planners, and selected line employees, new tasks for assembly planners were identified, arising from the changes in the manufacturing of the new autonomous acting products. The individual tasks were elaborated in detail to understand how, for example, artificial intelligence and robotics, new electronics, lasers and sensors, as well as new IT hardware and software, have changed the activities of assembly planners [11]. As a result, a task catalogue for the assembly planner regarding autonomous acting products was created.

In a validation workshop, all relevant stakeholders (from line team leaders to R&D to plant management) were involved to ensure a holistic perspective on the requirements for assembly planners regarding new autonomous acting products.

Calibration cabin space for adjusting the autonomous acting product	Plan calibration cabin (content such as setting up cabin reference points, column alignment, capacity, workplace, equipment)
	Interfaces with departments: R&D, Quality, Team Leader assembly line
	Creating of work instructions: e.g. operating material

Figure 2: Example of work tasks for assembly planners for autonomous acting products on a generic level

The result of the first step of the study is a catalogue of tasks necessary to plan the assembly line for autonomous acting products. In consequence, the job role of the assembly planner needs to evolve and adapt due to new requirements from autonomous acting products to handle the new planning tasks. In particular the work tasks for assembly planning with new IT-based challenges and AI requirements with the autonomous acting products were completely new for the assembly planners. In the assembly planning they were now confronted with technologies such as lasers, sensors or robotics. As a result, they were not able to plan work steps and workplaces, or to provide adequate tools for the shopfloor workers.

2.2 Step 2: The identification of new competences for assembly planners to cope with new work tasks

The identification of new competences for assembly planners to cope with new work tasks consists of a standard method to identify different competences for each work task in different assembly planner phases [12, 13]. This starts from work tasks assembly-planning related in the product development phase, continues with the factory planning phase, third the assembly line planning in general, fourth the assembly line planning in context of series production of the autonomous acting products and ends with tasks related to the overhaul of autonomous acting products as the customer returns the products. In particular the overhaul of autonomous acting products and the new challenges of planning steps for the shopfloor for AI review or IT-component review and substitution steps were not part of the work for the assembly planners so far. The different competences identified are clustered in professional and soft skills on the baseline of electronic components, IT-hardware and software components, sensors & lasers and robotic functionalities including AI [14]. The required competences for each work task are discovered with expert interviews from the company itself and with expertise from applied research (studies, consultants) [15]. Based on the results a competence catalogue has been developed and validated with the companies' HR department, with the assembly team, with factory planners, R&D involved in the development of the autonomous acting product and the production manager of the plant.

2.3 Step 3: The assessment of competence gaps

The competence assessment ensures that the required competences are available for all important work tasks in organisations and that employees are optimally qualified for current and future tasks [16]. In measuring and assessing competences, it is necessary to answer the question of which competences exist today and at what level, and which competences need to be developed or acquired in the future. The measurement results

in the CURRENT competences of the employees. These CURRENT competences can now be contrasted with the required TARGET competences revealed and needed for assembly planners to cope with the new work tasks for the planning of the production of new autonomous acting products. In this way, "gaps", which contain the objectives of the further training activities become visible by asking the assessed assembly planners whether they are able to cope with planning issues (green), whether they have minor competence gaps to cope with planning issues (yellow) or whether they have major problems to cope with planning issues (red) given the technological needs and planning steps for different workplaces (see Figure 3 for an example for such a competence review). The contents of the gaps represent the contents of the learning activities. Based on the results of identified work tasks and its competences for assembly planning (task catalogue and competence catalogue), the assessment of competence gaps has been carried out in workshop settings with the assembly planner team including members of the HR department. The outcome of the assessment workshop are the measurement results of competency levels needed to fulfil both current and future tasks for autonomous acting products – the competence gaps. The competence gaps are illustrated in a traffic light logic in a matrix for each work task and each technological challenge (e.g. robotics and AI, sensors and lasers).

	Electronics	Sensors and Lasers	IT Hardware and Software	Robotics
Provisioning place				
3.7 Planning of the provisioning place				
3.8 Interfaces to other departments R&D, Q, S, L				
3.9 Creating of work instructions				

Figure 3: Example of the competence measurement matrix of a assembly line workplace

After presenting the measurement results to the production manager and HR department, the decision for upskilling the assembly planners on the basis of competences identified to cope with new work tasks caused by autonomous acting products as a basis for learning activities has been made.

2.4 Step 4: The competence development

To be able to conceptualize upskilling activities for the assembly planners, the work tasks and the competences needed to cope with the assembly planning for autonomous acting product are considered as central reference points for the didactic design of job-related further training activities [17]. When determining the objectives of the further training activities to upskill the assembly planners, the design of the learning objectives, the selection of suitable learning forms and the content needed for the different learning units has to be seized and specified [18]. The learning objectives have been derived from the work tasks' need of assessed competences. Content for different learning units and nuggets have been developed by the company itself (e.g. R&D, distribution units) assisted by experts from applied research and by provider of new technology companies (e.g. manuals, Learning videos from manufacturers of new components on installation, sensitivity, etc.) [19].

In the assessment with the assembly planner team leaders and selected assembly line employees the tasks of the assembly planners were identified which will have to change for the benefit a successful assembly

planning for new autonomous acting products. This included also the qualitative characteristics of change in each task and their estimation of a minor or a major skill gap for the employees at the team level. Based on the identified skill gaps, the transformation paths for assembly planners can be derived from Figure 4 as well.

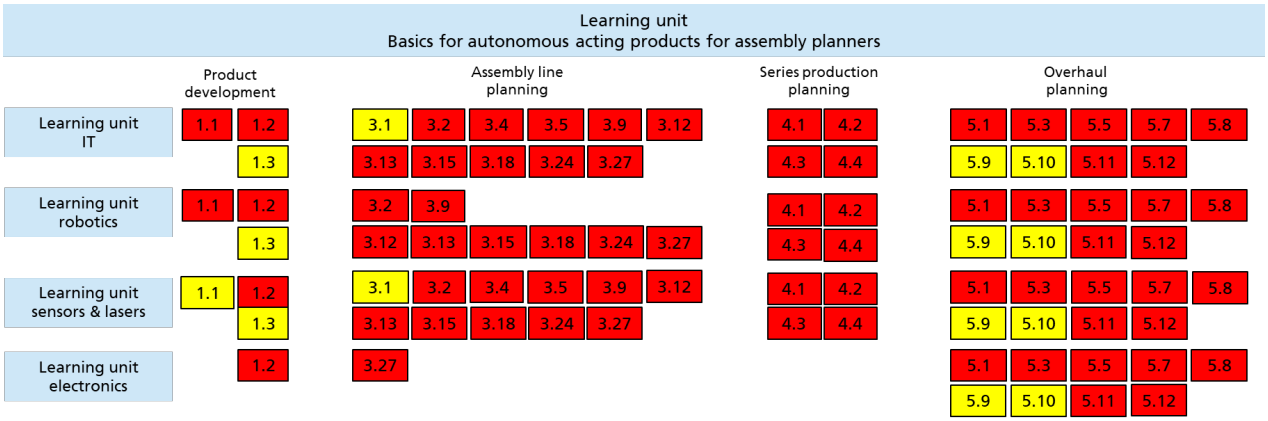

Figure 4: List of learning units and learning nuggets for each main task the assembly planner is engaged with new tasks due to the autonomous acting product line

3. Outcomes & Conclusions

Firstly, the work tasks for assembly planners to cope with new autonomous acting product needs for shopfloor planning and work organisation were identified. These are mainly work tasks including different and more complex electronic components, more sensors and lasers with different functionalities, greatly changed IT hardware and software components and – completely new – AI solutions and robotics functionalities compared to products assembled previously.

Secondly, the new competences for assembly planners to cope with these new work tasks were identified. These new competences are inevitable information and reference to assess, thirdly, current already existing and target competences for the assembly planners. Relevant skill gaps were identified by means of this assessment as well. These skill gaps for their part were then the starting line for the development of a learning concept for assembly planners. Competence development that means to close these skill gaps is indispensable for assembly planners to enable them to plan the autonomous acting product properly.

All in all, the case study serves as an example of a systematic and integrated approach to identify work tasks, relevant current and future competences, skill gaps and opportunities for competence development when dealing with digitalisation and new technologies at work. Furthermore, such a kind of approach can be transferred by the human resource departments as well as specific departments of the company where the new technologies are applied to other job roles and can be used for specific transformation activities within other domains and application fields.

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Biography

Alexander Karapidis (*1967) is Senior Researcher in the team Competence Management at the Fraunhofer Institute for Industrial Engineering, Stuttgart, Germany. His research interests focus on competence management and competence development both in service industries and advanced manufacturing. Currently, he focuses on the impact of digitisation on work, competences, competence development and leadership in services and production work.

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