

# **Process modeling for designing targeted knowledge transfer to integrate new employees into manufacturing companies, while taking social boundary conditions into account**

Vinzenz JEGLINSKY

*Faculty of Mechanical Engineering, Production and Logistics  
University of Applied Science Landshut,  
Am Lurzenhof, 84036 Landshut, Germany*

**Abstract.** There are a number of scientific approaches designed to increase employee retention during the onboarding process. However, these approaches often overlook workers in an industrial production environment. Programs to train new workers are generally centralized and are framed by bottom-line economic objectives. When observing the increasingly heterogeneous groups on the shop floor level, it is clear that more differentiation is needed, and this is what will be discussed in the initial stage of this dissertation project. Existing theoretical and practical approaches will be transferred into a scalable, normative process model, which includes social boundary conditions, to create a systematic approach to the targeted teaching of new production employees in manufacturing companies. Throughout the dissertation project, the approach will be evaluated using different scenarios in industrial environments.

**Keywords.** human factors in manufacturing, training production workers, diversity in production, social boundary conditions, appreciation, motivation

## **1. Introduction**

When searching for an “insurance policy” for their businesses, manufacturing companies commonly seek a profitable (and sustainable) competitive edge. However, industry conditions are dynamic and constantly changing, and manufacturers in high-cost countries in particular face major challenges. Recently, the so-called “human capital” factor has been recognized by the companies as a strategic success factor and noteworthy differentiator (Becker 2009). In addition to continuously developing their organizational and workforce strategies, companies are now focusing on the effective integration of new talent. In this case, recruitment, training, leadership development, employee retention, and setting new standards for ethics and morale (e.g. creating a culture of trust, loyalty and appreciation) are seen as the key factors. In this context, the term “War for Talents” was recently developed (Meifert 2002), and it becomes more and more apparent that money alone does not solve the challenges of acquiring and establishing a sense of loyalty in current and future staff. This statement is highlighted by the Maslow (1943) and Herzberg (1974) models in which they define different types and stages of motivation, stating that pay is not the decisive criterion in high-cost countries.

Due to the shortage of talented employees, people are beginning to realize that the recruitment process extends far beyond the new employee’s first day in the

company. Instead, this process should only be considered completed once the new employee is securely integrated into the organization (Berthel 2013). As evidenced by the term "onboarding," there are already plenty of scientific approaches targeted towards the notion that employee retention is strengthened simply by them joining the company (Mowday et al. 1982; Meifert 2008; Stein & Christiansen 2010). The benefit of related approaches is justified through the arguments that 1) it lower turnover, resulting in lower employee fluctuation costs, and 2) it improves employee work performance (Mowday et al.1982; Riketta 2002; Meifert 2002; Meifert 2008).

## **2. Current state of integrating workers and human factors into production**

Manufacturing companies are generally subject to strong sales fluctuations due to market conditions, and on-demand workforce capacity adjustments are an effective, economically based method for mitigating this volatility (Roeren & Jeglinsky 2014b).

One goal in the production industry is to keep qualified employees for as long as possible. On the other hand, a company has to be flexible to ensure delivery time and product quality, despite the peaks and valleys in annual production. This may lead to the implementation of present or new workers. Along with the reasons described above, other changes in staff, including plant expansion and restructuring, make new worker implementation a facet of daily business. Particularly in efficiency-driven and quality-driven production segments, the process of knowledge transfer plays a major role for integrating new employees. On the operational level, the term "training" is often used for the transfer of knowledge to new staff.

The main goal of production management is that new employees take over assigned tasks as soon as possible, but without a significant decrease in productivity, efficiency or quality. The principle of profit maximization often leads to extensive, structured, and centrally managed training programs, through which the new employees are to be integrated into the organization as quickly as possible. Due to the inherent nature of the aforementioned principle, the current focus is primarily on organizational, procedural and technological issues (Pennathur & Mital 2003). The human/interpersonal aspects are simply seen as another factor of production. This becomes clear when considering the number of scientific publications in the fields of economic and engineering sciences which have dealt with the integration of people and their needs into business and industrial environments.

Research on production systems and the integration of the human aspects therein can be found in some approaches. For example, the idea of a "holistic production system" states that all parameters must be incorporated to achieve the production objectives. Technical, economic and human-related aspects are taken into account, but here human aspects are clearly regarded as boundary conditions in production performance (Westkämper & Zahn 2009). Youndt et al. (1996) describe human-related aspects related to production tasks in a rather technocratic way, as the so-called "human capital" or human resource. Friedli and Schuh (2012) speak of a need for the transformation of human capital to modify a production area from a static organizational unit to a flexible one.

When looking at the fields of ethics and social sciences there are several approaches which also look at the human factor, but they are generally not linked to a specific field of production. A recent publication states that companies which choose to re-orient themselves towards values such as responsibility, integrity, fairness, honesty and loyalty tend to have success in their later economic

development (Trost & Terörde-Wilde 2013), however, these findings are not linked to a specific field of production. Göbel (2000) dealt intensively with the relationship between ethical and economically focused behavior, creating arguments against various economic theories going as far back as Aristotle. He then systematically considered individual interests within a corporate structure and then looked at specific management instruments for balancing ethical and economic issues that could potentially lead to conflict (Göbel 2000).

In recent decades the field of ergonomics has developed a great number of approaches to integrate human factors into the production environment. The International Ergonomic Association (IEA) has specified that human factors are key to the understanding of interactions among humans and other elements of a system in order to optimize human well-being and overall system performance (IEA council 2000). When discussing the relationship between human factors and performance, several theoretical frameworks have been developed in order to classify the effect of these relationships and to highlight the resulting opportunities (Bonney et al. 2000; Toriizuka 2001; Baines et al. 2005). In the specific field of production planning, a few quantitative programming models have been developed which take account of the differences in individuals in workforce planning (Thompson & Goodale 2006; Wirojanagud et al. 2007; Aryanezhad et al. 2009). They considered technical and human skills along with human issues such as hiring and firing workers, salary and (cross-) training.

In summary, there are various approaches and scientific discussions to integrating human factors. These utilize various means in order to achieve various objectives. However, an explicit approach to the training of new employees in the field of production, taking the social boundary conditions into account in a practicable manner could not be identified. The status quo reflects the current mindset and attitude toward managing production. In a nutshell: Profit maximization dominates training programs.

### **3. Enlarged recruitment pool in production**

Production in high-cost countries can be characterized by increasingly extensive market activity (i.e. regional, national, international, global) and a high level of automation in order to produce more and more complex products while keeping costs low. Within this paradigm, the following three significant trends can be observed.

To master the complexity of business operations in all its facets, the qualification profile is not just rising for highly qualified professionals (e.g. managers, engineers, etc.), but the qualifications for the workforce on the shop floor are also constantly being raised. This leads to a rising demand for highly qualified employees, particularly in production. This issue can be classified as a technology-driven trend. Another trend to be noted is that older employees are staying on longer. Increased statutory retirement ages and a lack of required skilled workers in high-cost countries such as Germany tend to result in the lengthening of the average working lifetime in the production field, though this can admittedly be partially linked to the threat to pension schemes in old age as well. Due to their wealth of experience, they are generally very welcome to companies. This issue can be classified as a trend driven by our changing society. The third trend is regional. The geographical radius for recruitment is expanding from regional, to national, international, and even global. This issue is influenced by the structural characteristics of the site environment.

Aspects such as the "follow-the-customer" strategy, pricing pressure (i.e. unit labor costs) and financing by subsidies often determine the location of a factory. Of course, considerations regarding the availability of skilled labor at the new location are always taken into account. However, economic factors also often drive the need to recruit skilled workers from outside the local site territory. This issue can be classified as a market-driven trend, but all three trends mentioned have a feedback impact on each other. In summary, the pool of potential recruits for a production facility can be enlarged using the following three dimensions: region, age and technological progress.

#### **4. The need for diversified training programs and outcomes**

As seen in the previous section, the composition of the production workforce is changing. Groups of production employees are becoming more and more heterogeneous, and this is happening on all fronts: qualification level, migration background, social background, age, gender, language and other social boundary conditions. As seen above, the differences are varied but noticeable, but they can all be traced back to the three highlighted dimensions: region, age and technological progress. Now, based on a typical quantitative workforce allocation over the different departments, the growing demand for highly qualified staff is bringing the "war for talents" to the shop floor. Following the storyboard of this publication, "human capital," which was described at the beginning as a strategic success factor and characteristic differentiator for companies, is once again a relevant factor. By always expanding the radius of recruitment, the demand for skilled production workers can be adequately covered. But now, the challenge of integration and keeping the new employees in the company over the long term begins.

The previous pages have set up the background for this dissertation project. In order to provide added-value to a now highly heterogeneous field, this project shall try to find a solution in the differentiated approach. With this approach, this paper shall investigate the opportunities found in displaying appreciation towards employees within the first days of new employee integration. To setup a culture of appreciation means having sympathy for the needs of the individual and specific groups involved (i.e. shop-floor, production, management, overall organization). Along with the technological and economic aspects, the human social boundary conditions shall be the key to this cultural change, as these human-related aspects are fundamental to the creation of a common base. Only then can there be a targeted knowledge transfer. This can perhaps be defined as a realistic number of sharable values. It's not about the abstract values promoted in prevailing debates, such as commitment, responsibility or criticism. Rather, this shall focus on "tangible" values of interpersonal relationships, such as mutual and respectful coexistence evidenced through gestures, facial expressions, tone or the representation of one's own personality. Also, the benefits of humor should be mentioned at this point, as it is one of the mightiest and simultaneously difficult tools utilized in the provisioning of knowledge. Though humor may be difficult to pass between various members of a heterogeneous groups, it can be done successfully if carefully cultivated. According to the idea of "front-loading" established in product engineering, the creation of common and sharable values is much more targeted at the time when a new employee joins an organization. In particular, this helps to avoid potential underlying conflicts between players due to deep individual and cultural issues. The result of this

dissertation project is a scalable, normative process model which can be adapted for any integration process of new production employees in manufacturing companies.

## **5. Methodology**

Based on the problem-solving cycle of complex interrelations for the systematic development of models in the field of system engineering, the following steps to develop the process model have been selected. First, an overview of approaches based on the various scientific disciplines was done, followed by a deeper investigation of relevant approaches. Finally, based on existing interdisciplinary approaches and partial solutions, a universal normative process model should be developed. In the following lines, the envisaged procedure is described in more detail.

First, a situational analysis is performed by surveying, describing, consolidating and validating the requirements and constraints of the teaching staff in the production environment. The next step is to search for solutions by collecting, examining and classifying existing scientific and practical approaches on the training of new employees. For this purpose, approaches are studied, classified and conceptually prepared for evaluation (e.g. andragogy and training, leadership and motivation, ethics and values, production systems, dealing with social changes, etc.). Then a solution shall be synthesized by comparing the knowledge gained with the requirements for designing a process model. The next step shall be the development of an initial hypothesis-based design concept followed by iterative developments based on the findings of practical evaluation. The last step shall be the evaluation of the process model in practice through application and expert interviews.

## **6. Conclusion and final discussion**

In a 2013 study, managers from 27 manufacturing companies from the region of Lower Bavaria in Germany were asked for their subjective opinions on the greatest challenges they anticipate in the next 10 years (Roeren & Jeglinsky 2014a). The participating companies were from diverse fields, with the largest group concentrated in automotive. Depending on their specific market and business models, the statements differed, but the statement ranked first was mentioned by 93% percent of the participants. An overwhelming majority of managers named finding enough qualified employees as one of the major challenges for the coming years. According to this outcome, there is a clear need to examine differentiated approaches for integrating new production workers by taking social boundary conditions into account. There are a lot of opportunities to be had by improving employee retention and performance, not just for the manufactures but also for their employees. To this end, the presented approach shall make an important contribution.

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