

Boundary crossing in product introductions considering humans, technology and organization

Martina BERGLUND¹ and Ulrika HARLIN^{2,3}

¹*Linköping University, Department of Management and Engineering, Division of
Quality Technology and Management, Linköping, Sweden*

²*Swerea IVF, Mölndal, Sweden*

³*Chalmers University of Technology, Department of Product and Production
Development, Division of Production systems, Gothenburg, Sweden*

Abstract. The objective of the paper is to analyze how a product introduction involving Swedish-Chinese collaboration was influenced by human, technological and organizational aspects. The study showed that technical challenges concerned the infrastructure for communication and quality issues; organizational challenges concerned the new project model and updating drawing versions; and human related challenges included cultural differences and communication. The product introduction was highly challenging by crossing earlier boundaries in the human, technical, and organizational subsystems. Strong work demands were placed on the individuals while offering great opportunities for individual learning. Concurrent development of a new project model resulted in organizational learning.

Keywords. HTO, cross-cultural, learning, Sweden-China.

1. Introduction

Collaboration between Swedish and Chinese companies in product introduction processes has increased during later years which challenges work and communication processes (Wlzlak & Johansson, 2014). Product introductions – also called industrialization – are part of the product realization process and associated with the transfer of the product from product development to serial production (Johansen, 2005), involving all those activities required to make it possible to produce a product. This includes development of both the product and the production system, e.g. technical adaptation and verification of the product and production system, but also the organization of several functions and human activities. Product introductions are complex and often characterized by a large number of difficulties and unexpected events requiring unplanned and fire-fighting activities (Almgren, 1999; Fjällström et al, 2009). Although work activities are dispersed in place, organizational affiliation and time, those involved may be considered as constituting a work system (Rasmussen et al, 1994) with tasks that contribute to an overall product introduction process.

In the case of collaboration between companies in Sweden and China in product introduction processes, there are additional challenges as the product introduction takes place in a cross-cultural work system (Berglund et al, 2012) and with a large geographical distance. Based on research on cultural dimensions (Hofstede et al., 2010; Spencer-Oatey,

2000; Trompenaars & Hampden-Turner, 1997) there are major national cultural differences between Sweden and China, which may influence human behavior. For example, in Sweden there is low power distance and informal communication with managers, while high power distance and inequality is accepted and expected in China. Regarding identity, Sweden is an individualistic society as opposed to China which is a highly collectivistic society where commitment is first to the group and second to the organization. Regarding motivation, Sweden is a “feminine” society and people value equality and life quality and where decisions are made by consensus and involvement by all. China, on the other hand is a “masculine” society driven by competition and success, sacrificing family and leisure for work. Other differences concern how laws and principles are valued, high in Sweden, while particular situations and people in China may override general principles. Swedes also put first focus on products, contracts and problems, while Chinese first concentrate on the whole and people involved and then focus on the specific tasks (*ibid*). Hence, specific considerations need to be taken during product introduction in a Swedish-Chinese collaborative context.

In this paper, findings from a case study of a product introduction involving collaboration between one Swedish and one Chinese company are reported. The objective of the paper is to analyze how the product introduction was influenced by human, technological and organizational aspects.

2. Humans, Technology and Organization

The HTO-concept (Humans, Technology and Organization) is regarded as a meta-concept as well as a model for analysis that takes into account human, technological and organizational components to understand and improve work systems (Westlander, 1999a). From being developed to improve safety within the nuclear industry, the HTO-concept has spread to other domains (Rollenhagen, 1997, 2003). The concept takes a systems perspective in which the three components interact in different ways, and it is valuable in research to understand work systems. Even if a specific component is focused, the other components in the HTO-concept may be analyzed and treated as influencing factors (Westlander, 1999a).

In the HTO-concept the “H” stands for individual aspects that are important to perform a task, such as knowledge and skill, experiences or relations with other people. Depending on what is in focus of the study it is possible to adopt different perspectives on the human, e.g. considering the human as a learner, actor or exposed to certain work conditions (Westlander, 1999b). Another way of looking at the human is to describe him/her at biological, cognitive, psychological and a level social level (Daniellou, 2001):

In this study of the product introduction in a Swedish-Chinese collaboration the humans are considered from combined perspectives. They are considered from a learning perspective, at a social level as well as a combination of being actors and/or exposed to the conditions of the work system.

The “T” in HTO, stands for the technical system, which can be divided into two parts. The primary technical system includes the physical production equipment that is devoted to maintaining the capability of the company, while the secondary technical system assists the administration and procedures of the company without being directly associated with the value adding activities of the business (Wäfler, 2001). This technical system can be described in different ways in relation to technical limitations, problems (both recurrent and stochastic), availability, and reliability.

The third component, the “O” includes how the work is organized and structured, both formally and informally (Westlander, 1999b). The formal organization includes job

definitions, responsibilities and powers, hierarchical positions, policies, business goals and strategies. Other aspects of the O-component are rules, procedures and cultural factors as well as relations between system components and subsystems. These all have a formal and informal side. In addition there are physical aspects of the O-component in relation to where people are located and how premises are designed (Weisbord, 2004).

3. Methods

An interactive research approach was applied for the case study consisting of an action-learning methodology, in which different actions are carried out to solve problems in practice (Aagard Nielsen and Svensson, 2006). The approach includes four main steps: 1) mapping/diagnosis, 2) feedback of results, 3) participation in development activities, and 4) follow-up/evaluation. In one of the Swedish case study companies, one development activity involved a real-time longitudinal case study (Yin, 1994; Siggelkow, 2007) of the described product introduction in order to highlight the work procedures and evaluate the company's newly adopted overall project model.

Data were collected through semi-structured individual interviews, group interviews and workshops. The interviews and workshop discussions were audio-recorded and transcribed. In total ten employees and managers at the Chinese company and five employees at the Swedish company were interviewed representing different organizational functions and constituting a variety of data sources (Yin, 1994). These functions included product development management, design, marketing and sales, project management, and production engineering at the Swedish company. In the Chinese company, the C.E.O., project management, quality management, purchase management, tool design management, and production management in four departments were interviewed. The interviews topics included preparations and activities related to the product introduction, encountered difficulties, organization and collaboration, work methods and routines, leadership, and learning from the product introduction.

Data regarding the experiences of the Swedish case study company were also collected during five company workshops held in Sweden, in which other companies also participated.

4. Case Company Description

The Swedish and the Chinese company belong to the same company group, which produces office equipment solutions and hand tools for office, manufacturing and home usage. The brand represents high quality products. The Chinese company is owned by the Swedish company since many years. Main research and development is carried out in Sweden, although there is an R&D department in the Chinese company. The company is certified for the quality management system ISO 9001 and the environmental management system ISO 14001.

The specific product introduction in focus in this case study was particular in the sense that it involved a product from the high-quality segment. It concerned a new model worldwide of its type intended for the European market, a very complicated product which required new working methods. The quality demands included high precision, measured parts and caution in handling the parts in production. Another particular aspect was that the product development was performed in Sweden with first industrialization in the Chinese subsidiary company as opposed to previous normal procedure when transferring production to China after achieving a stable production in Sweden. Finally, at this specific

product introduction a newly developed project management model at the Swedish company was to be applied in practice.

5. Results

5.1 Human Aspects

Human aspects strongly influenced the product introduction. Except for language barriers, there were also national cultural differences which resulted in difficulties to communicate about needs, demands and own capabilities. There were also examples of Chinese not being able to express their views directly to the Swedes, e.g. as stated:

"They usually say yes to everything and there you have to be reluctant whether they really will be ready... I see that now when we will buy equipment for an external supplier, there have not been any problems at all and then suddenly they start negotiate about the price and want to quit the agreement."

The Swedes found it challenging to know what the Chinese really understood of what was communicated about the new product and what they thought about it. It was also challenging to create a common vision and mindset regarding the higher quality standard of the new product. The Chinese had not worked with the same top quality standards, and it was a challenge to engage the operators in the work and involve them in improvement work. One of the Chinese managers stated that:

"Maybe as a Swedish manager, maybe he doesn't understand, maybe he or she is used to the Swedish way and think that also operators have a lot of ideas. But here it is not like that. They have ideas, but usually they don't say anything. They want to listen...they don't show their personality."

Other challenges were related to the need to develop personal networks and trust each other, to change attitude to respect time schedules and to develop skills and competences.

Interviewees from both companies stated that they learned a great deal during the product introduction. A Chinese manager put forward that important learning was the creation of quality group in the workshop and how this would spread throughout the organization:

"When we produce we should focus more on quality than on quantity. This is for me very important ... to tell Chinese people, the R&D group. I will also tell our supervisors and production manager to tell other operators how we think and why we have this group, how we plan in the future and so on."

5.2 Technical Aspects

The product introduction resulted in technical problems related to the product design, infrastructure for communication, and quality issues. Initially there were major product quality problems of the actual top quality segment product. Identified reasons were non-representative testing-prototypes, lack of technical facilities and measuring equipment for tolerance testing etc. Other reasons were rusty carriers, high atmospheric pressure, and lack of individuals' understanding of underlying problems. There was also lack of IT-support systems for handling documentation and information. Specifically there were shortages regarding testing processes, resources and use of fixtures, as expressed by the Chinese plant:

"Today we lack resources to make a test. Today we make some tests, but we don't follow. It is not in a professional way. We need a professional testing department"

"We also use some fixtures, but we don't use many... if we want to use the fixture, it has to be perfect, exactly as the specification ... you know the labour cost is low here, so it is easy to use people instead."

Also the material handling and packing was crucial for the product quality, requiring new packing solutions and careful handling, causing problems due to the lack of quality consciousness.

5.3 Organizational Aspects

During the actual product introduction, a new project model and work procedures was implemented and further developed. Initially there were challenges concerning the higher quality demands than the Chinese production plant was used to and update of documentation. Organizational challenges included the introduction and further development of a new project model, problems with updating versions of drawings, meeting-structures, unclear roles, non-established unclear work procedures and lack of quality awareness and quality-structured work. However, implementing structured work procedures caused initial challenges, but was found increasingly beneficial during the process: *"In China, people are not used to have a strict plan, so if people can understand that this is the plan, it is easy to explain in the future and it is easy to the project leader to drive the projects."*

Other challenges was the lack of time to prepare production and shortage of scheduled buffer-time in the project plan, risk analyses on both product and process, collaboration during critical phases, i.e. late changes etc. Also differences in team work, participation possibilities, and constitution of employees involved in the process was identified, were the following citation expressed the Chinese view: *"In Sweden there is the group, and the group has quite a lot of freedom, it is flexible, and they do the work from the beginning to the end. Here we have people to the same job, or are given a similar job and they are responsible for the parts, not the whole."*

In the later process of the product introduction a project leader was recruited in China, coordinating the communication with the project group in Sweden. This organizational approach was perceived valuable for the collaboration. For the actual product introduction, the quality approach in the Chinese plant was further developed where a team of seven people was established to focus on quality issues. Thus, these changes required dialogue with the Chinese department of Human resources as wages were linked to the piece rate and not considering participation in development work.

6. Discussion and Conclusion

In the case study of product introductions, boundary crossing challenges were identified related to humans (H), technology (T) and organization (O), but the results also show that the HTO-issues to a high degree influence each other, as described in the HTO-concept (Westlander, 1999a).

Regarding human issues (H), there were several individual aspects needed to be regarded in new ways to create appropriate conditions to perform their tasks, where specifically national cultural understanding and quality awareness was highlighted. Thus, interpersonal communication was needed in early phases to gain trust, a common mindset, understanding of needs, demands and capabilities, etc. Regarding technology issues (T), there were challenges both related to the primary technical system and the assisting secondary technical system (Wäfler, 2001), i.e. lack of technical facilities for testing and quality assurance, material handling, environmental conditions, the infrastructure for communication and lack of IT-support systems for handling documentation and information. Regarding organizational issues (O), national cultural differences caused challenges when implementing new structured work procedures. A new function was allocated in the Chinese company to overcome the challenges of new quality demands,

traditional ways of working, etc. Further the project model and checklists were continuously improved, as the project management also was part of development of the project model itself. Thus, the actual product introduction studied had a high potential for organizational learning, taking practical steps in that direction.

During the product introduction, company performance was affected by several interacting HTO-components. Human behavior was influenced by the technical systems, the organizational structure and national cultural aspects. One example of the outcome was the quality problems. Here the lack of technical test equipment and/or suitable carriers influenced the quality outcome, but also the degree to which quality issues were handled in a systematic organized way. Human aspects, such as overall quality thinking, work motivation and work engagement strongly influenced as well. In this product introduction, quality was in focus, and all three HTO-components needed to be developed in a way that they matched each other and there was a need to go beyond earlier boundaries in the human, technical, and organizational subsystems.. As a consequence, the product introduction was perceived as more challenging than normal. It created high work demands on the individuals, but it also offered great opportunities to learn. These learning experiences generated, however, further development and facilitated the operationalization of organizational learning.

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