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Opportunities for robotic automation in wood product industries: The supplier and system integrators´ perspective

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Abstract

In this study, the opportunities for automation in the poorly automated wood product industry are highlighted. This is accomplished by conducting a qualitative interview study of suppliers and system integrators for industrial robots active in this particular industry sector. Five case companies are chosen in order to explore the unique dimensions responsible for successful automation implantation in wood product companies. Results show that a low understanding of automation opportunities, unclear requirements specifications, and small production volumes are the main problems for suitable automation solutions. Although wood is a fragile and changeable material, existing technology allows its manipulation with industrial robots.

Keywords: Automation; industrial robot; supplier perspective; system integration; wood product industry

1. Introduction

Throughout many industries, automated systems and industrial robots are widespread and cover an extensive range of different manufacturing applications and processes. As leading industrial sectors in regards to automation

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of production systems, the automotive and the electronics industry can be named. At the end of 2015, the operational stock of industrial robots in the automotive industry is about 620,000 and in the industrial branch of electrics/electronics about 330,000 [1]. Together those two sectors account for over 57% of all operational industrial robots worldwide. It is expected that these numbers increase in the next couple of years.

For enterprises active in those industries, the planning and realization of flexible automation technology is an appropriate way and of crucial importance when the goal is to improve manufacturing capacity [2] or to avoid outsourcing to low-cost countries [3]. Production managers and technicians in companies active in those sectors have gained significant knowledge and experience of how to conduct automation projects with industrial robots since the 1960s. With successful, as well as with failed automation projects, the responsible personnel learnt what is possible and what is not [4].

However, in industries with low or no experience of the utilization of automation, discrepancies between what is requested by a company and what is actually the best way and feasible to fulfill these demands, can be observed. Company leaders are often interested in automating the most complex processes in their production, making an automation project hardly performable [5]. This phenomenon can be witnessed when attempting to copy successful automation projects from other industry sectors to industries with little to no experience of automation. Here, the lack of understanding crucial underlying factors, such as programming time and cost, additional equipment, or the personnel´s insufficient competence complicate automation projects. In many cases, this can result in poor experiences and loss of trust in new technologies [6]. Automated systems are often also very closely connected to some kind of digital data input, supporting the execution of machining operations. Therefore, automation projects often go hand in hand in with information technology (IT) projects. When executing IT projects, factors for their failure or success have been researched thoroughly [7]. However, this is only possible because the crucial influencing factors for the outcome of projects are known.

One of the least automated industrial sectors is the wood product sector. According to [1], only 0.2% of all industrial robots in operation worldwide are installed in the woodworking processes. The wood product sectors consist of the furniture industry, industrial timber house building, carpentry as well as joinery industry [8]. Here, manufacturing processes are mainly manual and characterized by a low understanding of possibilities for further development of production processes and systems [9]. In regards to automation of manufacturing processes, the wood product industry is lagging behind by about 20 to 30 years in comparison to the automotive industry, which can be understood as the manufacturing sector with the highest degree of automation [10].

2. Objective

The objective of this study is to identify factors, which have to be considered when industrial robots are to be implemented in manufacturing processes of wood product industries. The focus is hereby put on the possibilities and opportunities from the perspective of automation practitioners with the expertise and the experience of implementing automated systems in common wood working manufacturing processes. Consequently, data is collected through an interview survey in Sweden.

3. Research design

For selecting appropriate interview objects, the method of convenience sampling in combination with the snowball method has been used. Convenience sampling describes a sampling method where respondents are chosen by personal knowledge or 'friendship' [11]. In addition, snowball sampling is an appropriate and effective sampling technique when trying to reach a population which is unknown, 'hidden' or few in numbers [12]. Noy [13] describes snowball sampling as a data accessing method where contact information is provided for the researcher by other informants. The so-called snowball effect is, of course, repetitive because the researcher contacts all the 'new' informants given by 'old' informants.

In this study, large manufacturers of industrial robots, active on the Swedish market, have been chosen as a starting point on basis of the own knowledge of the researchers. Those respondents, which stated that they are not active in industrial applications in woodworking sector, were eliminated as candidates for an interview. Robot manufacturers, which only provide equipment for research to e.g. universities or sell to system integrators, were