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DIGITALIZATION IN WOOD PROCESSING COMPANIES - MANAGERS' PERSPECTIVE

Abstract: Information technology's constant and rapid development affects all industrial branches, including the wood processing industry. There is increased pressure to transform business and operations through digital innovation for companies to respond to accelerated market change, drive energy transition, and accelerate Industry 4.0 adoption. Real-time insights are required to optimize value and manage change continuously. Organizations are also attempting to support new working methods while improving training and safety. Ongoing operations and change programs may clash, and 'business' and 'digital' targets may be misaligned. Speed is critical in driving growth, but it can be challenging to determine where and what to invest in to build a business case for transformational investment and then ensure business value is delivered.
The paper examines the digitalization status of enterprises in the wood processing sector in Herzegovina. Research data is collected through in-depth interviews conducted among managers and owners of wood processing companies. The need for digitalization and the main challenges along the way were identified through interviews. Namely, the analyzed companies are currently not working systematically and planned on digitalization (they do not have an annual digitalization plan, they do not have a yearly budget for digitalization, they do not have annual plans for training employees related to digitalization, as well as a yearly budget for training employees related to digitalization). Companies do not use IoT, robots, augmented or virtual reality, virtual worlds, artificial intelligence, or Big Data technologies. All the interviewees stated that the digitalization of the production process is the biggest challenge due to the need for significant investment in digital equipment and employee training for its use.
Based on data collected through interviews, some general recommendations are given for improving digitalization in analyzed companies. The main recommendation is that the researched companies should upgrade their existing information systems regarding data integration (from different devices and programs) and better reporting. Further, a strategic and planned approach to digitalization is necessary in order to provide funds in the annual budgets both for the acquisition of digital equipment and for the training of employees to work with this equipment.

Keywords: Digitalization, managers, wood industry

1. INTRODUCTION

All aspects of business and society are being reshaped due to the widespread adoption of digital technologies. In some cases, implementing digital technologies causes disruption; in others, they add value by supplementing what already exists. Digital technologies can either completely replace or work in tandem with current technologies. They can sometimes develop new activities, services, innovations, and economic prospects. The power of digitalization lies in the fact that technology not only facilitates automation but also collects and stores data about tasks and activities, providing a record that can be analyzed to improve processes and anticipate future events (Agrawal, Gans, &Goldfarb, 2018). Internet of Things, blockchain, additive manufacturing, big data, artificial intelligence, cloud computing, augmented

and virtual reality, and the like are all hotly debated topics in the realm of digital technologies (Rindfleisch, O'Hern, &Sachdev, 2017). The fields in which digital technology might be applied vary, ranging from manufacturing and agriculture to professional services, health care, and beyond. In this way, the wood sector is no exception (Ciarli, Kenney, Massini, &Piscitello, 2021).

Although concepts of digitalization and digital transformation are sometimes used in the literature and practice as synonyms, there are referring to different phenomena. Some of the authors have attempted to distinguish between digitalization and digital transformation (Bockshecker, Hackstein, &Baumöl, 2018). Both terms are derived from digitization - the technological transformation of analog data into digital data (Da Silva Freitas Junior, Maçada, Brinkhues, &Montesdioca, 2016). Parida et al. (2019, p. 12) state that digitalization is the "application of digital technology to innovate a business model and generate new income streams and value-producing opportunities in industrial ecosystems." According to Hinings et al. (2018), "by the digital transformation, we mean the combined effects of several digital innovations bringing about novel actors (and actor constellations), structures, practices, values, and beliefs that change, threaten, replace, or complement existing rules of the game within organizations, ecosystems, industries, or fields." And according to Vial (2019), digital transformation is "a process that tries to better an entity by triggering major changes to its features using combinations of information, computation, communication, and networking technologies." According to these definitions, digitalization refers to incorporating digital elements into a company's business model as well as its products and services. In contrast, digital transformation refers to the more comprehensive process of adapting the entire company to work in tandem with digitalization.

The term digitalization is employed in this paper since the emphasis is on using digital technology to improve business models, ensure new income prospects, and maintain competitive advantages in the researched firms.

One of the key drivers of digitalization in the manufacturing sector is the ability of manufacturers to boost their responsiveness and agility in reaction to changing market conditions and consumer needs. Manufacturers can reduce waste and customer discontent by aligning their production cycles with seasonal demand. Optimizing processes, performance monitoring, and decision-making is feasible by shifting away from manual operations and toward automated solutions while avoiding rework, downtime, errors, and bottlenecks. As a result, both time and money will be saved. The speed of the manufacturing process is the first noticeable shift as the industry adapts to digitalization

Manufacturers must figure out how to best respond to rapidly evolving market needs and a rapid pace of new product introduction/innovation (Arumugam, Bhaumik, &Rangaraju, 2022). Digitalization boosts productivity instantly, letting businesses take on more demanding deadlines and moving projects forward more rapidly. Particularly, manufacturers will be able to swiftly adapt to new instructions from the engineering staff by switching between the design and production phases. A manufacturing company can digitalize anything from its supply chain and back office processes to its industrial automation and data analytics (Arumugam, Bhaumik, &Rangaraju, 2022).

The evolution of digital technologies may impact every facet of the company. It works well in manufacturing because of the numerous possibilities for increasing efficiency, productivity, and precision. For companies to remain competitive over the long term and to experience profitable development, digital transformation is a must.

Consequently, the manufacturing sector and the wood industry are confronted with a strategic imperative in the form of digital transformation.

The wood processing industry is thought to be delayed in adopting digitalization. The industry still faces data fragmentation, inadequate traceability, and a lack of real-time information (Santos, Carvalho, Barbosa-Póvoa, Marques, &Amorim, 2019). That was the impetus for examining the state of digitalization in the wood industry sector in Herzegovina. The authors examine the managers' perceptions of digitalization in a sample of ten companies from the "Herzegovina" wood cluster.

The data used in this research were gathered as part of the project "Boosting Competitiveness of the Wood Processing Sector in Herzegovina," which is part of the EU4Business initiative co-financed by the European Union and the Federal Republic of Germany.

The following research questions (RQ) are posed:

- RQ1: Do managers in wood companies recognize the importance of digitalization and are ready to invest in it?
- RQ2: What are the key challenges related to digitalization in wood companies from the managers' perspective?
- RQ3: How digitalized are wood companies in general, and how digitalized is their production process?
- RQ4: What are the manager's priorities in terms of digitalization?

The paper is structured as follows. The second section follows the introduction and looks at digitalization as a potentially transformative factor in the wood sector. The methodology is described in the third section. The fourth section contains the results and discussion. The paper finishes with a review of the findings and future research recommendations.

2. DIGITALIZATION AS A TRANSFORMING FORCE IN THE WOOD PROCESSING INDUSTRY

Deploying new digital solutions within an organization is not a simple undertaking, despite the huge impact and potential that the continuously changing digital technologies engender for organizations. Becoming digital is a strategic

decision requiring financial, human, and technological resources. As a result, management involvement is crucial during adopting and implementing new technology. Furthermore, digital transformation extends beyond the firm and affects its business networks. Inter-organizational linkages connect players immersed in the business network, allowing them to engage and build on shared culture, skills, and technologies.

The availability of user-friendly digital technologies, lower digital data storage costs, and the potential efficiency gains that may result in self-reinforcing a positive feedback loop are fundamental forces driving digitalization.

Digitalizing at least a portion of the organizational and business model is becoming more common, with the potential that organizations can realize efficiency improvements through even minor modifications (Björkdahl, 2020). Increasingly advanced new technologies enable firms to connect teams and foster closer working connections between headquarters and branches (Autio, Mudambi, &Yoo, 2021).

Using digital platforms to minimize operational costs, bureaucracy, and expenditures connected with commuting and business trips can result in significant employee savings (Hensher, Wei, Beck, Matthew, &Balbontin, 2021). Finally, digitalization has consequences for minimizing the environmental footprints of businesses (Elliott, Schumacher, &Withagen, 2020). At the same time, while the benefits may be immediate and evident, organizations, employees, and other players may bear costs. From an organizational standpoint, it is unclear whether the loss of subtle nonverbal forms of communication will impair internal efficiency, increase misunderstandings, and decrease empathy (Kniffin et al., 2021).

Yet, there may be direct costs to specific employee groups, likely to be concentrated inside particular firms. As a result, well-being and productivity may suffer, increasing the likelihood of resistance. Contextual factors, ranging from physical infrastructure provision to the architecture of supportive institutions to political pressures at the request of vested interests, can all disrupt things and merge in negative feedback loops (Amankwah-Amoah, Khan, Wood, &Knight, 2021). Furthermore, digitalization introduces numerous unknowns, which may fuel nostalgia and a desire to return to the status quo ante that characterized previous COVID-19 pandemics. Nor is such nostalgia motivated merely by dread and superstition: digitalization brings many high-probability dangers that are difficult to avoid or plan for, ranging from everyday security breaches to internet failures; knowledge of the latter's causes remains limited (Aceto, Botta, Marchetta, Persico, &Pescapé, 2018).

Providing people with the means to use digital technology is a serious challenge. Many small business owners still confront human resource and capability constraints, including lacking technical skills and digital literacy, despite the COVID-19 pressure to embrace digital technology (Amankwah-Amoah, 2021).

Recent studies (Adomako, Amankwah-Amoah, Tarba, &Khan, 2021; Rachinger, Rauter, Müller, Vorraber, &Schirgi, 2019) reveal that digitalization is being driven by increased business process competency, new forms of cooperation and consumer involvement, and a faster speed of innovation. Companies need to use digital technology more extensively in their value-creation processes to take advantage of business openings (Amankwah-Amoah, Khan, Wood, &Knight, 2021).

Research on digitalization varies widely; some studies have concentrated on the technology involved (Sony&Naik, 2020; Porter&Heppelmann, 2015), while others have emphasized the importance of structural shifts inside an organization (Duerr, Wagner, Weitzel, &Beimborn, 2015). There are also requests to broaden the scope of the research to include other types of complex problems, such as the difficulties brought about by the digital transformation of industrial organizations (Sony&Naik, 2020; Verhoef et al., 2019). Matt et al., 2015) have also called for empirical research to examine four dimensions (the use of technologies, shifts in value creation, alterations in organizational structure, and financial considerations) to find similarities and differences in the digital transformation strategies of various organizations. When describing the phenomenon of digitalization in industrial organizations, the existing literature is insufficient (Ivančić, Vukšić, &Spremić, 2019).

The massive amount of data created throughout the wood supply chain process can be used to extract useful information and improve management from forests to wood/paper manufacture (Zhang, Chen, Chen, &Chong, 2021). Similarly, new technologies have the potential to build a cyber-physical environment for the design and manufacturing of wood products, hence optimizing the respective processes (Chang&Chen, 2017). Several scholars are investigating the key features, uptake, and benefits of Industry 4.0 technologies in the wood sector (Molinaro&Orzes, 2022; Zhang, Chen, Chen, &Chong, 2021).

Recent research, however, has stated that the wood sector has made very little technological progress. Landscheidt and Kans (2019) point out that many steps in the production process still require human intervention. Many companies are unaware of the opportunities afforded by automation in this area (Molinaro&Orzes, 2022).

Digitalization in the wood processing industry is understudied in Bosnia and Herzegovina. Most recently published studies have investigated the frequency with which the wood industry introduces new products to the market (Ahmetašević&Gostimirović, 2016), the use of fundamental corporate finance principles in the wood industry (Džafić&Polić, 2018), the use of EU standards in the wood industry in Bosnia and Herzegovina (Panić, Hodžić, &Nezirević, 2015); and the identification of the main problems in the relationship between forestry and wood processing (Džafić, 2021).

There is a lack of literature similar to this paper's study of the managers' perspectives on digitalization in the wood sector in Bosnia and Herzegovina.

3. METHODOLOGY

Empirical research was done in Bosnia and Herzegovina (BiH) between November 29, 2021, and January 22, 2022.
The study was conducted as a qualitative interview study. Data were collected through interviews, more precisely through a semi-structured interview. In order to collect data to form answers to the research questions, respondents answered questions from four thematic blocks:
(1) The importance of digitalization and the readiness to invest in it,
(2) Challenges regarding the digitalization of the company,
(3) Estimation of the current state of digitalization in a company, and
(4) Priorities in digitalization of the company.
In addition to questions related to the mentioned thematic areas, respondents also answered general questions about the company (year of establishment, number of employees, annual income, business activities). They provided information about their position in the company.
Half of the interviews were in person, while the other half was via an online platform (Zoom). The interviews ranged in length from one to two hours. Considering that the research was conducted as an interview, it was necessary to record all the interviews to analyze the respondents' answers adequately. Before the interview, the interviewees were informed of the need to record the interview and consented to those mentioned above. To protect privacy, the names of the companies in the sample and the individuals who participated in the interviews have been omitted.
The results are presented as absolute frequencies; the exception is the length of the company's operations, which is presented as a mean (M) and standard deviation (SD).
Companies whose business activities belong to the wood sector were the target group, specifically the wood cluster “Herzegovina”, which includes 27 companies. After sending an invitation to participate in the research, ten companies from the "Herzegovina" wood cluster expressed their willingness to participate - accordingly, the sample comprised precisely those ten companies from the "Herzegovina" wood cluster (return rate is 37%).
The companies included in the research have been in business for about 25 years (M=25; SD=4). Most of them were founded before 2000, exactly 7 of them. Six companies employ between 10 and 50 workers, three companies have less than 10 workers, and one company has more than 50 workers.
The analysis of the realized annual revenue shows the following: three companies annually generate between 50,000 and 250,000 €, three companies between 250,000 and 500,000 €, while 4 companies annually generate more than 500,000 € of revenue.
The majority of responses (7 out of 10) were CEOs (Chief Executive Officers), while 3 were COOs (Chief Operating Officers).
Respondents provided multiple responses to the question about the primary business activities of the investigated companies. Analysis of their answers showed the following: furniture production – 6 companies; interior planning/design – 5 companies; the processing of panels (folding, cutting, pressing, CNC processing, etc.) – 4 companies; sale of furniture from other manufacturers – 4 companies; cutting, hauling and transporting timber – 3 companies; final production of solid wood panels – 3 companies; production of parquet and underlays for parquet and floors – 1 company; production of briquettes – 1 company.

4. RESULTS AND DISCUSSION

A database of answers was formed by systematizing the collected individual answers, representing the basis for obtaining adequate answers to all four research questions. The representations of answers by individual thematic blocks are shown in Table 1.

Table 1: The most represented managers' answers to four thematic blocks

A thematic block of question • Answers	Number of answers
The importance of digitalization and the readiness to invest in it.*	
• Digitalization has its benefits, but it is not yet a top priority regarding investment.	3
• Digitalization is necessary for the company to retain its competitive advantages, but investment must be financially justified.	4
• Digitalization is critical for increasing productivity, but investment must be financially justified.	6
• Digitalization is necessary, but the company lacks the financial resources to invest in digitalization	1
• The company lacks a systematic approach to digitalization and investment at present.	10
Challenges regarding the digitalization of the company.*	
• Employees have a low level of knowledge about digitalization.	5
• High employee turnover rate.	4
• Resistance to the digitalization of lower levels of management and employees.	2
• Lack of finances.	1
• Digitalization of production.	10
Estimation of the current state of digitalization in the company.	
• Production	
– is not digitalized.	3
– digitalized 10-20%.	5
– digitalized 50-60%.	2
• Digitalization of accounting and financial operations	
– below 50%.	2
– 80%.	8
• The company digitalized	
– 10-20%.	8
– 30-40%.	1
– 80%.	1
Priorities in digitalization of the company*	
• Production digitalization.	8
• Data integration - the exchange and collection (unification) of data from various digital devices and other programs used by companies.	5
• Renewal of existing and purchase of new digital devices and tools.	10
*multiple answers	

Source: Authors' preparation

The first research question (RQ1) sought to find out whether managers in wood companies recognize the importance of digitalization and whether they are ready to invest in digitalization.

The managers' answers to questions in the first thematic part (Table 1) underline their awareness of digitalization's benefits and importance. Previously stated and managers' focus on financial justification also represents the answer to the first research question (RQ1).

More than half of the managers answered that digitalization is critical for increasing productivity, while four answered that digitalization is necessary for a company to retain its competitive advantages. However, managers show a relatively conservative approach regarding investment in digitalization. Namely, without reasonable financial justification, they are not ready to invest in digitalization. Even in that case, a third of managers answered that investment in digitalization is not a priority. Although managers recognized the necessity of digitalization, they all answered that the company lacks a systematic approach to digitalization and investment. According to prior research, flexible organizational structures encompassing independent business units separated from the headquarters, agile organizational forms, and digital functional areas are particularly favored for firms' digital transformation (Sklyar, Kowalkowski, Tronvoll, &Sörhammar, 2019; Verhoef et al., 2019). However, interviewed managers did not recognize the need to set the formal context for digitalization by making digitalization a strategic priority, redefining roles and responsibilities, and providing a continuous flow of finance.

The second research question (RQ2) sought to find out the challenges related to digitalization in wood companies from the managers' perspective. The collected answers offered "digitalization of production" as an answer to RQ2.

All managers saw the digitalization of production as highly challenging. That challenge is highlighted in companies primarily cutting, hauling, and transporting timber (3 companies). Those companies use only mechanical machines, so their managers obviously estimate that their production is not digitalized. However, the managers concluded that replacing those mechanical machines with digitalized devices for the current volume of work has no economic justification. In addition to the challenges related to production, most managers saw a lack of employees' knowledge about digitalization and a high employee turnover rate as the main challenges in digitalization (Table 1).

Two managers answered that resistance to the digitalization of lower levels of management and employees is a high challenge. It's worth noting that only one manager highlighted a lack of financial resources as a significant challenge for digitalization.
The third thematic block of questions was related to managers' estimation of the current state of digitalization in the company and offered an answer to the third research question (RQ3). Only two managers estimated the level of production digitalization between 50-60%, and half of the managers estimated production digitalization between 10-20%. In comparison, three managers answered that the production process in their firms is not digitalized (from companies primarily engaged in cutting, hauling, and transporting timber).
The situation with digitalizing business processes (accounting and financial) is significantly better. Eight of ten managers estimated the digitalization of these business processes as 80%. However, the estimation of the overall digitalization of the company is low (less than 20%) for most companies (Table 1). Only one manager estimated the overall digitalization of his company as 80%, meaning that 4/5 of all business activities in his company are digitalized.
The answers to the fourth thematic block of questions, which covered issues related to priorities in the digitalization of the company, i.e., the fourth research question (RQ4), are also in line with the assessment of the level of digitalization. Namely, eight of ten managers answered that one of the high priorities is the digitalization of production. However, managers from companies that have digitized production to some extent as a high priority saw connecting data from already digitized devices with business information systems that, as a rule, store data related to financial and accounting operations and sales. Also, all managers know the age of the company's existing digital equipment and the necessity to procure new.
The analyzed responses suggested recommendations for enhancing and more intensive digitalization for the assessed companies:

- IS data integration upgrade - ensuring the exchange and gathering (unification) of data from various digital devices and other programs used by businesses is essential.
- Using modern visualization techniques, improve the reporting component of information systems and ensure real-time reporting (ensure monitoring of basic business indicators in real-time and on different devices – mobile phones, tablets, etc.),
- Promote the digitalization of the entire company, particularly the manufacturing process
- Identify the person in charge of carrying out and monitoring digitalization.
- Address the company's digitalization in a planned manner. Create a digital strategy, and annually create a digitalization plan and budget.

5. CONCLUSION

The presented research results indicate that most companies in the wood processing sector in Bosnia and Herzegovina have just stepped onto the digitalization path. Although the data analysis collected through in-depth interviews showed that interviewed managers are aware of the necessity of digitalization, they still struggle with providing human, financial, and IT resources. Data reveal that managers need to set the formal context for digitalization by making digitalization a strategic priority, redefining roles and responsibilities, and providing a continuous flow of finance, which is currently not the case. Also, the findings show that the digitalization of the production process is the biggest challenge due to the need for significant investment in digital equipment and employee training.
Managers should understand their role in easing the organization's transition to a digital mindset. Because digitalization brings uncertainty and may arouse worries in the workforce, managers must understand and address their concerns and strive for a solution that works for everyone. One strategy for shifting mindsets is to involve employees early on and give them the freedom and encouragement to shape the firm's digitalization actively.
Although this research provides valuable insights and recommendations, it has several limitations. First, the analysis is based on the verbal accounts of managers in small and medium wood processing companies from Herzegovina. Due to the small sample size, the generalization of findings to other contexts is somewhat restricted.
Second, the evidence is based on the interview responses of single individuals (managers) and thus may not represent all digitalization efforts in their company. It would be helpful to extend the analysis by interviewing multiple individuals in the company to enhance objectivity and obtain an even deeper understanding of the approaches and initiatives toward digitalization
Future research could expand the sample, i.e., the inclusion of other wood processing companies from Bosnia and Herzegovina and widely in the research, which would enable an analysis of the level of digitalization in the wood processing industry in Bosnia and Herzegovina and its regions. By doing so, it would be possible to gain a deeper insight into the state and practices of digitalization in wood processing companies in Bosnia and Herzegovina and where they may lag or lag behind worldwide trends.

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