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Industry 4.0 Perception Among Employees: A Study in the Textile Industry

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Abstract

The aim of this study is to determine the expectations of individuals in different age groups working in the textile industry regarding the changes that may occur with Industry 4.0, their predictions and the values they attribute to work, thus creating an idea about the future of working life.

In this study, participants were asked demographic questions such as age, gender, education and employment status, profession, length of service, current position and time spent in working life; Additionally, the Industry 4.0 Scale developed by Rıza Demir (2019) and the Meaning of Work Scale developed by Steger et al. (2011) and whose Turkish validity and reliability were confirmed by Akın et al. (2013) were used.

With the Industry 4.0 Scale, employees' knowledge levels about Industry 4.0, their thoughts about robotic developments, their thoughts and attitudes about the possible effects of Industry 4.0 on working life and possible changes in recruitment were evaluated. The Meaning of Work Scale measures individuals' attitudes towards the work they do and the meaning of their work. The scales are in 5-point Likert type. Convenience sampling method was used in the study. The online survey form prepared via Google form was applied by the Human Resources directorate of the textile factory where the application was carried out, by sending it online to the e-mail addresses of people involved in working life. According to the data obtained from 292 people, it has been observed that the expectations of employees in different age groups from business life vary according to age groups, while the meaning of work and awareness of Industry 4.0 do not change according to age groups. A positive and significant relationship was determined between the expectations of employees in different age groups from business life and the meaning of work. In this context, some suggestions have been developed about the textile industry and its future in parallel with the changes that may occur with Industry 4.0.

Keywords: Textile, Apparel Sector, Industry 4.0, Meaning of Work, Working Life.

INTRODUCTION

The concept of work has evolved throughout human history, experiencing various changes in its significance. Alongside these changes, numerous concepts have been introduced into the working environment. One of these concepts is Industry 4.0, which was initially presented at the Hannover fair. New technologies such as 3D printers, artificial intelligence, internet of things, and nanotechnology have entered the working world with Industry 4.0.

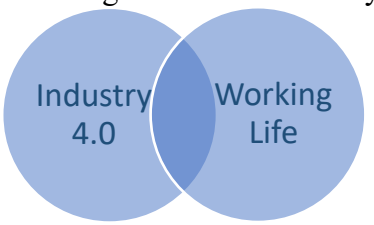

Figure 1. Industry 4.0 and Working Life

Industry 4.0 in manufacturing refers to a manufacturing era where computers and software play integral roles in production technologies and become essential components of the manufacturing process. To understand the foundations of Industry 4.0, it is necessary to examine its preceding history. The fundamentals of Industry 4.0 are the technologies shown in Figure 2; Additive manufacturing (3D printers), Internet of Things (IoT), Virtual Reality - VR, Cyber Security - CS, Big Data - BD, Autonomous robots, Cloud Computing - CC Simulation technologies and artificial intelligence applications. (Chun, Junyang, 2014; Chen, Xing, 2015; Thames and Schaefer, 2016: 13; Schwab, 2017; Xu, Xu and Li, 2018; Mrugalska and Wyrwicka, 2018; Falani, Aguiar, and Forno, 2021; 551).

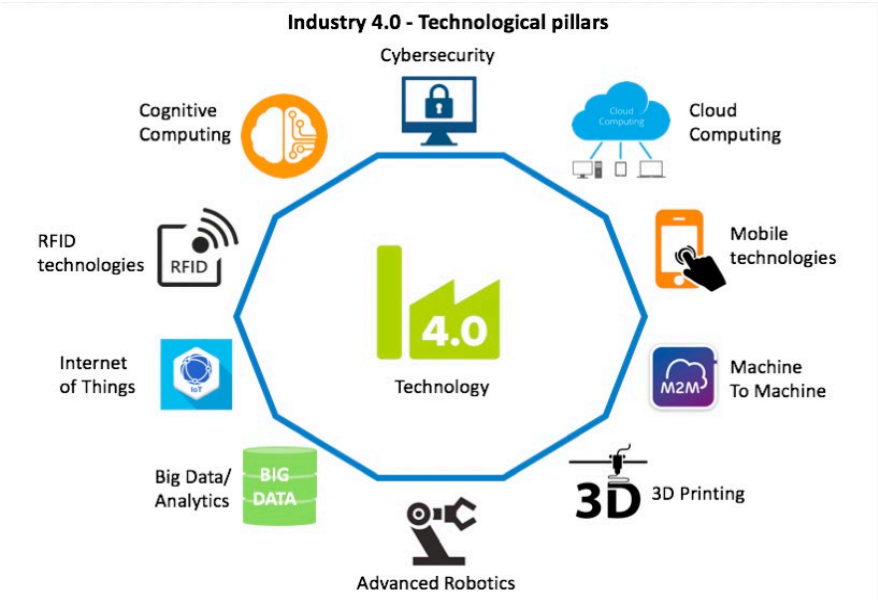

Figure 2. Technologies for Industry 4.0 (Gerbert, et al., 2015; Saturno et al., 2017; Petrillo et al., 2018; Melanson, 2018).

Businesses are currently undergoing the fourth major industrial transformation. Each iteration has brought about improvements through new production technologies, systems, and advancements. From the early stages of mass production to the modern era and beyond, every method has undergone some form of development. The four historical periods of manufacturing are as follows:
Industrial Revolution (Industry 1.0): Steam power and water were utilized to establish the first mechanized production methods. This period witnessed significant technological developments in the textile ındustry (Agarwal, 2017: 1063).
Industry 2.0: Companies began using more efficient electrical machinery and assembly lines for mass production. Notably, the textile industry also experienced advancements, such as the evolution of the sewing machine (Landes, 2003: 40).
Industry 3.0: The inclusion of computers and information technology, including micro processing, programming, and telecommunications, marked the third industrial revolution.
Industry 4.0: The current manufacturing industry relies on information technology, but with numerous improvements. It focuses on digital connectivity and the full integration of manufacturing processes with hardware and software. Industry 4.0 builds upon the foundations of Industry 3.0 by incorporating autonomous systems supported by data and machine learning, reducing the need for extensive human involvement and establishing smart factories.
Unfortunately, the textile sector, which is one of the most important sectors in the world that contributes to the economic welfare of the countries and the employment of workers, could not fully implement Industry 4.0.
The literature review shows that while Industry 5.0 is mentioned in other sectors, the textile sector is still in the early stages of Industry 4.0 implementation. Current directions of Industry 4.0 in the textile sector primarily revolve around the application of technologies aimed at computerization and process automation, with a focus on increasing efficiency and reducing costs. Projects involving augmented reality, 3D printing, and simulation technologies in the textile, clothing, and apparel domains are still in their infancy and typically rely on creativity tools and software (Souza et al., 2021).

1. INDUSTRY 4.0

Industry 4.0 represents a new era of industrial revolution where textile businesses adopt and integrate advanced technologies to achieve sustainability and gain a competitive advantage. According to Sunblad (2018), Industry 4.0 brings about various changes in production, including improved efficiency, reduced error rates, and enhanced quality through the introduction of technological advancements. Economic sustainability plays a crucial role in the adoption of smart systems and Industry 4.0 technologies in textile enterprises. Several studies have revealed that apparel businesses are more inclined to adopt Industry 4.0 technologies through advanced business intelligence solutions (Ahmad et al., 2020: 1-23).
Research shows that Industry 4.0 has made significant contributions to the production and services of the textile industry, enhancing organizational performance by improving production and service quality. Additionally, it has been determined that Industry 4.0 positively impacts production, services, and all stages of the product life cycle, providing new business and production methods, as well as increasing competitiveness by improving processes. However, effective technology application is crucial for these positive effects to be realized (Ślusarczyk, et al., 2019: 52-69).
By integrating smart technologies, Industry 4.0 enables the production of high-quality products at lower costs, facilitates changes in labor dynamics, and increases productivity through the utilization

of advanced technologies. Moreover, Industry 4.0 can enhance process improvements and increase the competitiveness of enterprises by revolutionizing the entire product life cycle (Lu, 2017; Ślusarczyk, 2018: 245).
In addition to providing a systematic review of the development process of Industry 4.0 in the textile sector, this article also examines employees' level of knowledge about Industry 4.0, their perceptions of robotic advancements, the potential effects of Industry 4.0 on working life, and possible changes in employment. Additionally, the study explores the relationship between employees' perception of Industry 4.0 and the meaning they attribute to their work.

Aim and Method

The primary objective of this study is to determine the expectations of individuals in the workforce regarding the changes that may occur with Industry 4.0, their predictions, the meaning they associate with their work, and to gain insights into the future of the textile sector.
The study focuses on white and blue-collar workers employed in a textile factory, and the convenience sampling method was employed for ease of access. Data analysis was conducted using the IBM SPSS 22.0 program.

Research Method

This research adopts quantitative analysis techniques, where an online questionnaire was distributed to employees in a textile factory via email addresses provided by the Human Resources department.
The questionnaire was sent randomly to 500 individuals, selected through convenience sampling, out of the total employee population of 1084 but feedback was received from 292 participants (response rate 58%).

Data Collection Tools

In this research was used the following data collection tools:

- Demographic Questionnaire: This questionnaire collected information on participants' age, gender, education, position, and years of experience in the working life.

- Work and Meaning Inventory (WAMI); Developed by Steger Michael F. et al. and adapted into Turkish by Ahmet Akın et al. (2013). The scale measures individuals' attitudes towards the work they do and the meaning of their work. In this study, found a Cronbach's Alpha value of 0.91, indicating high internal consistency.

- Industry 4.0 Perception Scale; Developed by Rıza Demir (2019), this scale consists of 17 questions and assesses participants' perceptions of Industry 4.0. It comprises four sub-factors: robotic developments, work-life impact, Industry 4.0 knowledge, and the recruitment process. The scale demonstrated a Cronbach's Alpha value of 0.76, indicating satisfactory internal consistency.

2. RESULTS

Looking at the demographic information of the employees taking part in the research, 52% of the participants are female and 48% are male, and the average age is 34.2 in terms of age groups. (min: 22, max: 48)

Working hours in the institution are as follows.

Table 1: Distribution by Working Years in the Institution.

Working Years		
Less than 1 Year	42	14,2
1-5 Year	84	29,1
6-10 Year	46	15,9
11-20 Year	66	22,8
21 Years and Above	53	18
Total	292	100

Before conducting any statistical evaluations, the data was examined for normal distribution. As the data did not follow a normal distribution, non-parametric tests were employed for the analyses.

Table 2: Comparison of Work and Meaning Inventory by Age Groups

Work and Meaning Inventory	$\bar{X} \pm SS$	$\tilde{X}[Min - Maks]$	**Test Statistics**
22-34	30,1±7,2	30 [21- 50]	U=9046,499 p=0,318
35-48	37,5±5,6	40 [10- 50]	

U= Mann Whitney U test p<0,05 Significance level

When assessing the Work and Meaning Inventory (WAMI) based on age groups, no statistically significant difference was observed for either age group (p=0.318).

Table 3: Correlation with Scales of Meaning of Work and Industry 4.0 Perception by Age Groups

Age/ scales			**Work and Meaning Inventory**	**Industry 4.0 Scale**
22-34	**Work and Meaning Inventory**	r	1	-0,57
		p		,787
	Industry 4.0 Scale	r	-,057	1
		p	,787	
35-48	**Work and Meaning Inventory**	r	1	,338**
		p		,007
	Industry 4.0 Scale	r	,338**	1
		p	,007	
**. Correlation is significant at the 0.01 level (2-tailed).				

When examining Table 3, no significant correlation was found between on the work and Meaning of Work Inventory for individuals in the 22-34 age group. However, a positive and significant correlation (r=0.338 p=0.007) was found between the scores on the scale for individuals in the 35-48 age group.

3. CONCLUSION

When evaluating the overall results of the study, it can be argued that there is a difference in the perception of the meaning of work between different age groups While working is primarily seen as a source of income for the 22-34 age group, working may be seen as a form of self-expression for the 35-48 age group. This finding is consistent with Young et al. It is consistent with a study conducted by. (2013) found that expectations regarding working conditions did not differ significantly between age groups. Similarly, in the research conducted by Çetin Aydın and Başol (2014), it was stated that there was no significant difference between age groups, but 80% of employees over the age of 45 saw working as a source of income.

The analysis conducted in this study revealed that employees in the 22-34 and 35-48 age groups have different perceptions regarding robotic developments. In addition, it was observed that employees in the 35-48 age group were less satisfied with robotic developments than employees in the 22-34 age group.

The analysis conducted in this study revealed that employees in the age groups of 22-34 and 35-48 have differing perceptions regarding robotic developments. Furthermore, it was observed that employees in the 35-48 age group expressed lower satisfaction with robotic developments compared to employees in the 22-34 age group. Additionally, a significant positive correlation was found between participants' perception of Industry 4.0 and the meaning they attribute to their work (p=338)

No statistically significant difference was found in the mean scores on the work and meaning inventory between the different age groups (p=0.318). Notably, the younger age group, being more immersed in technology, may lead to potential changes in the working structure of the textile sector,

altering business practices and perspectives. This group is likely to adopt virtual applications in the workplace, promoting their widespread use, and exhibit greater sensitivity towards work accidents and occupational diseases through virtual training. It is inevitable that the textile industry, being one of the most significant sectors globally with substantial contributions to economic development and employment, will benefit from the adoption of Industry 4.0 applications, leading to professional growth and improved outcomes. Consequently, textile businesses should implement Industry 4.0 and digital transformation, taking advantage of cost-effective and advanced technologies, responding to increased competition and declining customer loyalty, addressing complexities in the supply chain, recognizing the importance of proximity and fast delivery, prioritizing sustainability, and leveraging digital business models to adapt to the accelerated pace of globalization.

At the same time, machine learning, smart fabrics, artificial intelligence, internet of things, supply chain management, environmental protection, big data, automation and cyberphysics are crucial and prominent terms and fields shaping current and future work worldwide. In the textile sector, various areas such as real-time communication, carbon fiber, computer applications, health services, and sustainable development emerge as developing or unexplored realms within the scope of Industry 4.0. It is highly recommended that the sector creates suitable environments and conduct studies to address these and similar issues, fostering further development. Key automation technologies in spinning, weaving, and other aspects are essential for the advancement of the textile industry. Textile 4.0 represents a process chain of autonomous production. To progress further, strategic actions must be established, including the integration of traditional manufacturing industries with smart technology as the next stage of development. Moreover, promoting the development of pivotal smart manufacturing technologies and enhancing the training of skilled personnel are imperative. Initiating pilot projects and sharing experiences can be a promising approach, particularly in the context of fostering collaboration and competitiveness among small and medium enterprises.

The textile industry should remain cognizant of new challenges and respond with appropriate measures to reduce production costs, enhance productivity, stimulate industrial growth, transform the workforce structure, and ultimately improve the competitiveness of enterprises and regions. In this context, technological innovation and skilled personnel will be the main drivers of industry transformation. The significance of qualified human resources cannot be understated. However, challenges such as embracing digital culture and education and managing organizational change may arise during this process. Therefore, it becomes crucial to attract and retain creative individuals with strong analytical skills who can adapt to today's technological changes. Retaining qualified employees, providing necessary training, and offering growth opportunities have become indispensable factors in addressing these issues, as emphasized by Nagy et al. (2018).

Ethics Committee Approval: The research was found appropriate by the decision of …… University's Social and Human Research Ethics Committee dated 14.11.2023 and numbered 2023/12-4.

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