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Shaping Labor Expectations in Industry 4.0: Automation, Policy, and
Workforce Dynamics in Turkey's Food Industry

Doctoral School of Sociology and Communication Science

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PhD Dissertation

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Budapest, 2026

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Acknowledgments

First and foremost, I would like to express my deepest gratitude to my advisors, **Dr. Vicsek Lilla Mária** and **Dr. Pintér Róbert**, for their exceptional guidance, patience, and invaluable support throughout this challenging dissertation journey. Their expertise and support have shaped my research and academic growth. Since the beginning of my doctoral journey, **Dr. Vicsek** has always shown confidence in me, and her support has been crucial to my achievements. **Dr. Pintér**, my co-supervisor, supported me navigate the challenges I encountered through his experience and guidance. I would also like to thank my professors in my department for their inspiring expertise and dedication to fostering a supportive academic environment, which has contributed significantly to my scholarly development.

I am endlessly grateful to my beloved family, my mother, **Emel Sinik**, and my brother, **Mertcan Sinik**, for their unconditional love and support throughout my life. Their belief in me and their constant encouragement throughout both my academic and personal journey have been the greatest sources of strength carrying me through this process. Despite the physical distance between us, I have always felt their love and trust beside me, and the courage they instilled in me has enabled me to overcome every challenge.

My dearest mother, **Emel Sinik**, with her warm heart and beautiful smile, is a constant source of love, happiness, and strength in my life. Her unconditional love, endless support, and faith in me have carried me through even the most difficult moments. She has always make me feel that I am capable of overcoming whatever life brings. She has encouraged me to live my life courageously, always reminding me that she is beside me, that she trusts me, and that I can succeed. She has shared her own strength and light with me, allowing me to find and embrace my own. Knowing that she believes in me has given me the courage to believe in myself, take brave steps, and build the life I truly want, always surrounded by her infinite love and support. I feel deeply fortunate to have her as my mother.

My dear brother, **Mertcan Sinik**, has always been one of the strongest and most reassuring presences in my life. The perspective, determination, and success he has built in every aspect of his own life have enlightened my path and motivated me to continue moving forward. His strength has inspired my own, and his love and belief in me have made me feel that I never have to face life's challenges alone. Knowing that he has always stood beside me has meant more than I can express.

I am also grateful to **Tulu Eda Akdemir Sinik** and my beloved nephews, **Mete Sinik** and **Atlas Sinik**, who bring infinite love, happiness, and joy into my life. My family's love and support have been essential in helping me reach this milestone, and I will remain forever grateful to my beloved family.

I am deeply grateful to my beloved partner, **Enzo Bastias**, whose unconditional belief in me, love, and support have been the source of strength throughout my doctoral journey and in the pursuit of all my dreams and aspirations. He stood by my side through every challenge, constantly reminding me of my inner strength. His deep faith in me has been a guiding force in my journey. During difficult times, his sincere confidence in me and continual encouragement became my guiding light. His presence in my life is a true gift, filling my days with happiness, peace, and laughter that makes even the hardest moments feel lighter. I am endlessly grateful for his love, kindness, and ability to see the very best in me.

I would also like to express my deep gratitude to my friends, who are not simply companions but an irreplaceable part of my family. Their endless support, kindness, and belief in me have strengthened me through every challenge. My heartfelt thanks go to my dear friends **Melis Karakoç**, who is like my sister, **İnay Gürsoy**, and **Mehran Sehi**, whose presence in my life has been a true gift. They have stood by my side through both difficult and joyful times. Having friends like them is one of life's greatest gifts, and I am endlessly thankful for their love, laughter, and the unbreakable connection we share.

The support of my extended family has also been a source of strength, offering me constant encouragement and love. I am deeply grateful to the **Bayazitoğlu** family, my beloved aunt **Meltem**, my dear uncle **Ethem**, and my cousin **Berk**, whose kindness and belief in me have always lifted my spirits. Their continued support has brought me happiness and motivation, and I deeply cherish their presence in my life. I also sincerely thank my uncles, **Osman Mestan Avcı**, **Hulki Tuncer**, and their families my aunt **Hatice Sinik** for their faith in me and encouragement. Their support has always been deeply meaningful.

I would also like to honor the memory of my dear late grandmother, **Ulviye Avcı**, whose warmth and wisdom illuminated the lives of everyone around her. She was a woman full of joy, and wisdom, someone who taught me to know what I want in life and to express myself fearlessly. Her warmth and belief in me have been an endless source of strength. In every moment we shared, her words remained in my heart, giving me strength in the most difficult

times. Her wisdom, her joyful spirit, love, and her boundless support will always be a source of inspiration for me, guiding me throughout my life.

Finally, this dissertation is dedicated to my beloved father, **Ahmet Sinik**, whom we lost ten years ago. Though he is no longer here to witness this milestone in my life, I have always felt his unwavering support through my memories of him, as a guiding force that I carry deep in my heart in a way that goes beyond faith or belief. My father was my first best friend and my greatest supporter. He was the one who encouraged me to follow my unique path, to build a life filled with meaning, fulfilment, and happiness, and he reminded me of this until his very last day. Looking back, I realize that the courage I had in the most defining moments of my life and the strength to make bold and meaningful decisions all came from the inspiration he and my mother gave me. I know he would be incredibly proud and happy to see me reach this stage of completing my PhD. Though I can no longer share this achievement with him in person, his love, wisdom, and belief in me will always be with me. This work is a reflection of his faith in me, and I dedicate it to him with endless love and gratitude.

I extend my appreciation to everyone who has been a part of my journey, directly or indirectly. I have reached this moment carrying something from each of you, and I will always be grateful from the bottom of my heart.

1. Introduction

Technological innovation has continually reshaped production methods, economic structures, and labor markets. Today, technologies such as artificial intelligence (AI) are increasingly integrated into everyday life and industrial production, generating both opportunities and challenges (Brynjolfsson & McAfee, 2012).

Technology continues to play a central role in economic development and industrial competitiveness. In this dissertation, the Fourth Industrial Revolution (4IR) refers to the broader socioeconomic transformation associated with the growing convergence of digital, physical, and biological technologies (Schwab, 2016), whereas Industry 4.0 refers more specifically to the integration of interconnected, automated, and data-driven technologies into industrial production (Özyıldırım & Özbay, 2019). Industry 4.0 can therefore be understood as the manufacturing dimension of the broader Fourth Industrial Revolution. Technologies associated with Industry 4.0, including artificial intelligence, robotics, algorithms, and digitally connected production systems, are reshaping how goods and services are produced and have intensified debates about their implications for labor markets and employment (Özsoy, 2018).

The adoption of new technologies is influenced by public policy, organizational strategies, and institutional conditions. Investments in digital infrastructure, workforce training, and reskilling initiatives may reduce adjustment difficulties associated with technological change (TÜSİAD, 2016). Coordination between policymakers and businesses is therefore frequently presented as important for supporting workforce adaptation and maintaining competitiveness during technological transformation (Erer & Erer, 2020; Şener & Elevli, 2017).

In Turkey, these dynamics are particularly salient. The economy remains highly labor-intensive, with international competitiveness historically tied to relatively low-cost labor, especially in manufacturing, textiles, and food production (TÜSİAD, 2016; Yılmaz, 2016).

The food industry provides a particularly relevant setting for examining the relationship between labor-intensive production and technological upgrading. Earlier sectoral research characterized parts of Turkey's food industry as comparatively slow to adopt automation because production processes remained labor-intensive and involved sector-specific technological and organizational constraints (Kaya et al., 2010). This earlier assessment is used as historical context rather than as evidence of the sector's current level of technological adoption. Although automation may improve production efficiency, the realization of these

benefits depends partly on organizational readiness and workers' access to reskilling and upskilling opportunities (Paoli, 2020; McKinsey Global Institute, 2018).

Against this backdrop, this dissertation examines how workers in Turkey's food industry experience and respond to the technological transformation associated with Industry 4.0. Drawing on the Sociology of Expectations (Brown & Michael, 2003), it also analyzes how organizational and policy-level expectations concerning automation and workforce adaptation are constructed and interpreted. By comparing workers' and managers' accounts with selected policy documents, the study examines how expectations about technological change relate to people's experiences at work and to organizational and policy priorities.

This dissertation is structured as follows: Chapter 1 introduces the research problem, questions, significance, and country and sector context. Chapter 2 reviews the theoretical and empirical literature. Chapter 3 presents the data and methods. Chapter 4 reports and discusses the empirical findings. Chapter 5 summarizes the findings and presents the study's limitations, contributions, implications, and recommendations for future research. The appendices contain the interview guides and supplementary materials.

1.1 Defining the Problem

Industry 4.0, characterized by digitalization, automation technologies, and data-driven manufacturing, is transforming production systems across industries worldwide. While these innovations promise efficiency gains and productivity growth, they also reshape occupational structures and redefine roles, creating uncertainty in which opportunities and risks coexist. The widespread adoption of automation raises critical questions about changing skill requirements, shifting labor arrangements, and the broader socioeconomic consequences of technological transformation (McKinsey Global Institute, 2018; Özışık & Erdil Şahin, 2022).

Earlier sectoral research documented differing levels of technological development across subsectors of Turkey's food industry, including canned food, frozen products, poultry, pasta, and confectionery (Kaya et al., 2010). These findings provide background on the sector's earlier technological conditions rather than a current measurement of automation levels.

Among the most pressing concerns are workforce restructuring and potential job displacement. Automation may reduce demand for some repetitive and lower-skilled tasks while changing the competencies required in existing occupational roles. Without effective planning and accessible adaptation opportunities, workers and workplaces dependent on labor-intensive

production may face employment uncertainty, skill mismatches, and adjustment difficulties (TÜSİAD, 2016).

These challenges are particularly intense in Turkey, where the food sector plays a central role in employment and economic development. Turkey's competitiveness in international markets has long relied on relatively low-cost labor, especially in labor-intensive industries such as food production (TÜSİAD, 2016; Yılmaz, 2016). However, technological upgrading may alter the conditions under which low labor costs provide a competitive advantage, as productivity, quality, flexibility, and technological capacity become increasingly important components of international competition.

Addressing these challenges requires coordination among government institutions, employers, and workforce-development actors. However, the implementation of technology-adoption and workforce-adaptation strategies remains uneven (Özsoy, 2018). This unevenness raises questions about whether different occupational groups have comparable access to training, organizational support, and opportunities to adapt to changing production systems.

From this perspective, the implementation of Industry 4.0 technologies in Turkey's food industry presents both economic opportunities and socially differentiated challenges. Balancing efficiency gains with job security, skill development, and quality requirements depends on organizational capacities, workforce conditions, and the broader policy environment. This dissertation therefore investigates how workers and managers experience and interpret technological transformation and compares these accounts with national policy expectations concerning automation, competitiveness, and workforce adaptation.

1.2 Background of the Study

Technology encompasses a wide range of artifacts, processes, institutions, and socio-technical systems that serve functional purposes in accomplishing tasks. This broad scope, which includes tangible objects such as machines and devices alongside systemic arrangements such as the Internet and organizational processes, provides an essential foundation for understanding the contemporary role of technology (Dafoe, 2015). However, as Leo Marx (1997) argues, the complexity of the concept often produces misinterpretations, particularly in deterministic approaches that overlook the dynamic interaction between society and technological change.

Technological change interacts with social institutions and should not be treated as an autonomous force producing predetermined social outcomes (Dafoe, 2015). This perspective

is important for examining how Industry 4.0 and automation may reshape labor processes under different organizational and institutional conditions.

Within this broader trajectory, Industry 4.0 represents the manufacturing dimension of the Fourth Industrial Revolution and involves the integration of interconnected, automated, and data-driven systems into industrial production. Technologies such as robotics, the Internet of Things (IoT), artificial intelligence, and machine learning can increase efficiency, reduce costs, and enable data-driven decision-making (Schwab, 2016; Özyıldırım & Özbay, 2019). However, technological change does not necessarily eliminate occupations outright; it may also reconfigure work organization, responsibilities, and competency requirements (Feddoul et al., 2023; Kaasinen et al., 2023). The extent to which workers benefit from these transitions depends partly on access to reskilling and upskilling opportunities, supportive workforce policies, and organizational adaptation strategies (McKinsey Global Institute, 2018).

To analyze these transformations, this dissertation employs the **Sociology of Expectations (SoE)** as a theoretical framework. SoE highlights how future-oriented narratives shape present actions and strategies, particularly in contexts of technological disruption (Brown & Michael, 2003). Expectations about technological potential not only reflect anticipated futures but also performatively guide investments, adoption, and organizational change (Borup et al., 2006).

Sociotechnical imaginaries can privilege particular visions of technological progress while giving less visibility to alternative experiences and concerns (Jasanoff & Kim, 2015). In labor-intensive sectors such as the food industry, this perspective raises questions about whether narratives of productivity and competitiveness give sufficient attention to job displacement, uneven adaptation, and unequal access to reskilling. The dissertation therefore examines how workers' roles change alongside new technologies in Turkey's food industry and how expectations about the future shape organizational and policy decisions.

1.3 The Definition of the Research Direction: Questions and Objectives

As Industry 4.0 technologies and automated systems transform industrial production, concerns have grown regarding how the workforce in Turkey's food industry is changing. Organizational practices and the broader policy environment provide important contexts for understanding how workers experience and respond to these changes. The overall aim of this dissertation is to examine workers' current experiences of technological transformation and analyze their expectations regarding how work may change in the future.

This research specifically investigates how blue-collar and white-collar workers perceive automation systems and new technologies. Understanding these perspectives requires attention to the interplay between personal experiences, professional backgrounds, and broader societal factors. One of the main concerns of this dissertation is how workers' expectations about the future affect their positions in the labor market. In this way, the study aims to contribute both academically and practically to debates on the future of labor in Turkey's food industry by examining the consequences of automation and technological change in the workplace.

Building on this foundation, the dissertation examines technological transformation across workforce, organizational, and policy levels. Particular attention is given to how workers and managers experience automation, how organizational approaches affect workforce adaptation, and how national policy documents construct expectations concerning technological transformation and the future of work.

Question 1: How do blue-collar and white-collar workers in Turkey's food industry perceive the impacts of Industry 4.0 technologies on their current work experiences and future employment prospects?

Sub-Question 1.1: How do workers describe their current roles, challenges, and interactions with automation technologies in the workplace?

Sub-Question 1.2: What concerns or expectations do workers have regarding job security, role transformations, and skill requirements?

Sub-Question 1.3: How do workers anticipate changing their positions in response to further technological adoption?

This question examines how workers experience technological change and how these experiences shape their expectations regarding future employment. Drawing on the Sociology of Expectations, it explores whether automation is perceived primarily as an opportunity, a threat, or a combination of both, and how such perceptions influence adaptation strategies (Brown & Michael, 2003).

Question 2: What implications do Industry 4.0 technologies have for labor dynamics and workforce structures in the food-production workplaces examined, and how do organizational strategies and future-oriented expectations shape workforce adaptation?

Sub-Question 2.1: How are job roles and responsibilities changing across occupational groups, and how do workers interpret these changes in relation to their future positions?

Sub-Question 2.2: What skill gaps, training needs, and differences in access to organizational support emerge as automation systems are introduced?

Sub-Question 2.3: How do the interviewed managers approach technological implementation, workforce adaptation, and changing skill requirements while pursuing productivity and competitiveness?

This question broadens the analysis from individual experiences to organizational and sectoral transformations. It examines how automation affects workforce structures, skills requirements, and employment patterns, while also exploring how managerial expectations and organizational strategies shape workforce adaptation and development.

Question 3: How are national policy expectations concerning Industry 4.0 interpreted within managerial accounts, and what patterns of alignment and tension emerge when these expectations are compared with workplace experiences in the selected food-production settings?

Sub-Question 3.1: How do the selected national policy documents frame Industry 4.0, industrial modernization, competitiveness, and workforce adaptation?

Sub-Question 3.2: How do the interviewed managers interpret these policy expectations in relation to organizational priorities, financial capacity, production requirements, and workforce readiness?

Sub-Question 3.3: What areas of alignment and tension can be identified among policy narratives, managerial accounts, and workers' workplace experiences?

This question compares the future-oriented expectations constructed in national policy documents with their interpretation in managerial accounts and with workers' reported workplace experiences. It identifies areas of alignment and tension across policy, organizational, and workplace levels without assuming a direct causal relationship between policy narratives and organizational practices.

Together, these questions highlight the layered nature of labor transformation under Industry 4.0. Question 1 focuses on workers' experiences and expectations, Question 2 examines workforce transformations and managerial approaches, and Question 3 compares policy-level

expectations with managerial interpretations and workplace experiences. By integrating these perspectives, the dissertation examines how technological change is constructed and experienced across workplace, organizational, and policy levels in Turkey's food industry.

1.4 Significance of Dissertation

Automation and digital transformation have generated extensive debates regarding productivity, competitiveness, and the future of work. The significance of these debates extends beyond technological adoption because their consequences depend on how work, skills, and adaptation responsibilities are reorganized. This dissertation examines these issues in Turkey's food industry through a focus on labor dynamics and future-oriented expectations.

According to the BCG Global Production Cost Index figures reported by Yılmaz (2016), Turkey's production-cost index stood at 98, compared with 100 in the United States and 121 in Germany at the time covered by the source. These figures provide a historical illustration of the cost-based competitiveness attributed to Turkey during that period and should not be interpreted as current production-cost levels. The comparison is relevant here because it demonstrates the earlier economic context in which relatively low production and labor costs were presented as competitive advantages. As technological capabilities, productivity, and digitalization have become increasingly important, cost-based competitiveness alone provides an insufficient basis for understanding Turkey's industrial position.

The food industry provides an analytically important setting because automation and digitally integrated process control may reduce costs, improve food quality and safety, and minimize energy use and waste (Paoli, 2020). At the same time, technological transformation may change tasks, skill requirements, and employment structures (McKinsey Global Institute, 2018; Özışık & Erdil Şahin, 2022).

Existing studies of Turkey's Industry 4.0 transition, including those by Dursun and Şengül (2018) and Dikkaya et al. (2018), provide valuable insights into its implementation and economic implications. However, comparatively less attention has been given to workers' expectations or to the relationships among future-oriented policy narratives, managerial interpretations, and workplace experiences of automation. Sociological research connecting these levels in Turkey's food industry remains particularly limited.

This gap highlights the significance of the present study. By focusing on a strategically important and labor-intensive sector, the dissertation contributes empirical insight into how blue-collar workers, white-collar employees, and managers experience and anticipate

technological transformation. Theoretically, it applies the Sociology of Expectations to examine how anticipated technological futures are constructed and interpreted across policy, organizational, and workplace levels. The findings may also help policymakers and employers understand why workers have different opportunities to learn new skills, receive support, and adapt to technological change.

1.5 Country & Sector Context: The Food Industry in Turkey

Food Processing 4.0 represents a significant transformation in global food-production systems, with the potential to improve quality, safety, efficiency, and sustainability. Technologies such as robotics, intelligent sensors, automated monitoring, and big-data analytics are reshaping how food is processed, packaged, and distributed (Hassoun et al., 2023). Nevertheless, the implementation of these technologies can vary across firms and production settings depending on financial, technological, and organizational conditions.

Earlier sectoral research documented the adoption of automation and process innovations in subsectors including canned food, frozen products, poultry, pasta, and confectionery (Kaya et al., 2010). This evidence provides an earlier baseline for understanding the uneven development of technological capacity across Turkey's food industry and is not treated as a current measure of sector-wide adoption. The production-cost comparison reported by Yılmaz (2016) illustrates the importance attributed to relatively low production and labor costs in Turkey during that period. At the same time, firms within the food industry differed substantially in their technological and organizational capacities. These differences provide historical context for examining the uneven character of technological transformation, rather than a current measurement of firm-level adoption

This coexistence of technologically advanced and labor-intensive production reflects the segmented character of Turkey's food industry. Industry-oriented reports identify the sector as an important area for modernization and industrial upgrading (TÜSİAD, 2016), but differences in firm capacity, workforce skills, and policy implementation continue to shape the pace and form of transformation. Introducing new technology therefore involves more than purchasing machinery. It also requires changes in how work is organized, with the process shaped by firms' financial resources, institutional support, and the demands of food production.

The sector combines labor-intensive production with stringent quality and safety requirements and includes firms with substantially different levels of capital, technological readiness, and workforce capacity. It is economically important because of its contribution to employment,

production, and exports, while also remaining socially significant because of its relationship with food security, rural livelihoods, and consumer well-being. Its heterogeneous production structures make it possible to examine how global technological pressures interact with local structural constraints.

These sectoral characteristics provide the immediate context for the workplaces examined in this dissertation. The following subsection reviews the broader policy environment in which technological modernization and workforce adaptation are framed in Turkey.

1.5.1 Turkey's Industry 4.0 and Workforce Transformation Context

Industry 4.0 requires states to adapt industrial, educational, and labor-market policies to changing production dynamics. Policies supporting technological modernization are also expected to address the social and labor-related consequences of automation while promoting economic growth and global competitiveness (Özsarı Şişman & Bayrakdar, 2024; Ulusoy, 2021). From the perspective of the Sociology of Expectations (SoE), such frameworks are not merely technical responses to technological change; they also contain future-oriented narratives that shape how transformation is imagined, justified, and governed.

The consequences of Industry 4.0 vary across countries according to their economic structures, institutional capacities, and labor-market conditions (Philbeck & Davis, 2018; Ulusoy, 2021). Workforce adaptation has consequently become a central policy concern, particularly in relation to higher education, specialized skills, and continuous reskilling (Özışık & Erdil Şahin, 2022). However, adaptation cannot be assumed to occur automatically or equally, because access to its opportunities is shaped by socioeconomic inequalities, institutional constraints, and differences in organizational capacity.

To understand how national policies present the future of technology and work in Turkey, this dissertation reviewed selected policy documents published by the *Ministry of Industry and Technology* and the *Ministry of Labor and Social Security*. The purpose is not to evaluate policy effectiveness but to identify the recurring national narratives and priorities within which technological transformation and workforce adaptation are discussed. Table 1 summarizes the main themes identified across these documents.

Table 1. Main Themes Identified Across Reviewed Policy Documents

Main Theme	Main Focus in the Reviewed Policy Documents	Relevance for This Dissertation
Digital transformation and	Industry 4.0, automation, artificial intelligence, digital infrastructure, data-driven production, cybersecurity, green	Shows how technological transformation is framed in Turkey as a pathway toward

Main Theme	Main Focus in the Reviewed Policy Documents	Relevance for This Dissertation
industrial modernization	transformation, and technological upgrading	modernization, productivity, and global competitiveness.
Innovation, competitiveness, and SME transformation	National Technology Initiative, entrepreneurship, R&D, public-private collaboration, technology ecosystems, university-industry cooperation, and SME digitalization	Connects national competitiveness narratives with company-level expectations and highlights the uneven capacity of firms, especially SMEs, to adopt Industry 4.0 technologies.
Workforce adaptation and skills development	Reskilling, upskilling, lifelong learning, vocational education, Sector-on-Campus initiatives, İŞKUR programs, and MYK qualifications for emerging digital occupations	Directly links policy narratives to workers' concerns about skills, training, job security, role transformation, and future employability.
Inclusive and uneven transformation	Women's employment, youth and NEET groups, regional inequalities, access to training, social inclusion, and unequal institutional capacity across regions and sectors	Supports the dissertation's human-centered approach by showing that adaptation to technological change is shaped by gender, age, region, education, and socioeconomic position.
Food industry transformation and sectoral specificity	Food and beverage sector modernization, automation, smart production, sustainability, quality and safety standards, R&D limitations, and sector-specific technological challenges	Justifies the food industry as a strategically important and analytically relevant site for examining Industry 4.0, labor expectations, and workforce transformation in Turkey.
Policy implementation gaps and monitoring limitations	Limited labor-specific strategies, weak feedback mechanisms, insufficient sector-specific action plans, uneven implementation, and limited monitoring of policy outcomes	Highlights the gap between ambitious policy expectations and the limited mechanisms for monitoring how technological transformation affects workers, firms, and sector-specific labor conditions.
Future-oriented policy narratives and the Sociology of Expectations	Digital transformation is commonly framed as necessary, inevitable, and beneficial for future competitiveness, productivity, and national development	Connects the reviewed policy discourse to the Sociology of Expectations by showing how expectations do not merely describe possible futures but actively shape present strategies, investments, and labor adaptation processes.

The comparative thematic analysis summarized in Table 1 indicates that the reviewed documents frame technological modernization, innovation, workforce adaptation, and inclusive development as interconnected components of Turkey's Industry 4.0 agenda. These priorities reflect broader expectations regarding the future roles of technology, labor, firms, and public institutions. The following sections examine these themes and their relevance to automation-related expectations in Turkey.

1.5.1.1 National Industry 4.0 and Technological Transformation Agenda

Turkey's approach to Industry 4.0 is embedded within a broader national development agenda that positions technological transformation as a key driver of economic growth, industrial modernization, innovation, and global competitiveness. Across the reviewed policy

documents, digital transformation is presented as a strategic necessity for increasing productivity, strengthening technological capabilities, enhancing industrial efficiency, and improving Turkey's position within global value chains (Republic of Türkiye Ministry of Industry and Technology, 2024a; Republic of Türkiye Ministry of Industry and Technology, 2022; Republic of Türkiye Ministry of Industry and Technology, 2024d). Industry 4.0 is therefore portrayed not merely as a technological shift but as a comprehensive transformation process requiring institutional coordination, innovation-oriented policies, and long-term investment in technological infrastructure.

Within this agenda, research and development, entrepreneurship, university–industry collaboration, the diffusion of advanced technologies, and access to finance are presented as complementary mechanisms for strengthening domestic technological capabilities and creating higher value-added production systems. The National Technology Entrepreneurship Strategy and Action Plan (2022–2025) identifies venture capital, technology-focused investment funds, and alternative financing instruments as mechanisms for supporting technology entrepreneurs, start-ups, and the commercialization of emerging technologies (Republic of Türkiye Ministry of Industry and Technology, 2022; Republic of Türkiye Ministry of Industry and Technology, 2024d).

Another prominent element of Turkey's Industry 4.0 agenda is the digital transformation of small and medium-sized enterprises (SMEs). Given their significant role within the Turkish economy, policy initiatives emphasize improving their technological readiness and facilitating their access to innovation networks and technological resources. SME modernization is consequently presented as an important component of the national innovation ecosystem. At the same time, the documents acknowledge that technological adoption varies across firms, sectors, and regions, revealing the uneven character of digital transformation (Republic of Türkiye Ministry of Industry and Technology, 2022; Republic of Türkiye Ministry of Industry and Technology, 2024d).

The agenda also extends beyond domestic capacity building to the attraction and circulation of international knowledge, expertise, and technological talent. Initiatives such as the proposed TechnoVisa program and efforts to engage the Turkish scientific and entrepreneurial diaspora illustrate this international dimension of the technological-modernization agenda (Republic of Türkiye Ministry of Industry and Technology, 2024d; Turkish Employment Agency (İŞKUR), 2024a).

A comparative reading of the reviewed documents suggests that, while technological transformation is presented as a largely positive and necessary pathway toward

competitiveness and economic development, comparatively less attention is devoted to its differentiated social and labor consequences. This tension between ambitious modernization expectations and uneven adaptation capacities provides an important context for the following sections.

1.5.1.2 Workforce Adaptation and Skills Development

Across the reviewed policy documents, workforce adaptation is presented as a critical requirement of Turkey's technological transformation agenda. The diffusion of Industry 4.0 technologies, automation systems, artificial intelligence applications, and digital production processes is associated with changing occupational structures and skill requirements. Technological transformation is therefore framed not solely as a technical or economic challenge but also as a labor market issue requiring continuous investment in human capital and workforce capabilities (Republic of Türkiye Ministry of Industry and Technology, 2024e; Republic of Türkiye Ministry of Labor and Social Security, 2024; Republic of Türkiye Ministry of Industry and Technology, 2024d; Republic of Türkiye Ministry of Industry and Technology, 2022).

Within this framework, reskilling, upskilling, lifelong learning, and vocational education emerge as recurring policy priorities. Rather than treating skills acquisition as a process completed through formal education, the documents portray learning as a continuous activity throughout workers' careers and associate employability with the capacity to acquire new competencies and adapt to changing technological environments (Turkish Employment Agency (İŞKUR), 2024a; Turkish Employment Agency (İŞKUR), 2024b; Republic of Türkiye Ministry of Labor and Social Security, 2024). This orientation also extends to those preparing to enter the labor market. Initiatives such as the GALIP Program seek to introduce students to innovation ecosystems and emerging technologies at an early stage, reflecting the expectation that adaptation should begin before labor market entry (Republic of Türkiye Ministry of Industry and Technology, 2022).

The reviewed documents also emphasize institutional mechanisms intended to reduce skill mismatches, including vocational qualifications, workplace-based learning, university–industry collaboration, and sector-specific training programs. İŞKUR and the Vocational Qualifications Authority (MYK) occupy central positions in these efforts. In response to technological transformation, MYK has introduced occupational standards and qualification frameworks for emerging digital professions in areas such as artificial intelligence,

cybersecurity, robotics, cloud computing, and digital transformation (Vocational Qualifications Authority (MYK), 2024; Turkish Employment Agency (İŞKUR), 2024a).

In the documents reviewed for this dissertation, technological change is generally presented as a manageable process that can be addressed through education, training, and continuous skills development. Workforce adaptation is framed as a pathway toward employability, productivity, and national competitiveness. However, presenting adaptation mainly as a matter of learning new skills may place much of the responsibility on workers and organizations. It can leave less room to consider working conditions, power relations, changes in how work is organized, and who bears the costs and risks of technological change. Differences in access to education, training, and organizational support may also receive less attention.

From a Sociology of Expectations perspective, the emphasis on reskilling, digital competencies, lifelong learning, and workforce flexibility constructs adaptation as both a necessity and a responsibility, thereby shaping present institutional priorities and labor-market interventions (Borup et al., 2006). Whether workers experience this anticipated adaptation as an opportunity, obligation, or source of uncertainty remains an empirical question for the dissertation.

1.5.1.3 Inclusive and Uneven Transformation

A comparative reading of the reviewed policy documents indicates that technological transformation is generally presented as a national pathway toward economic modernization, competitiveness, and innovation. From the analytical perspective adopted here, however, its opportunities and challenges are unlikely to be distributed evenly. The transition toward increasingly digitalized and automated production systems takes place within existing social, economic, and institutional structures. Workers, firms, and regions therefore possess different capacities to participate in and benefit from technological change. Technological transformation should consequently be understood not only as industrial modernization but also as a socially differentiated process shaped by unequal access to resources, training, technological infrastructure, and institutional support.

A recurring policy priority is the expansion of labor market participation through initiatives addressing women's employment and entrepreneurship, youth employment, the number of individuals classified as NEET (Not in Employment, Education, or Training), and access to vocational education and workforce development. Mentorship, networking, and support mechanisms for women in technology-intensive sectors similarly reflect an expectation that participation in innovation ecosystems should be broadened (Turkish Employment Agency

(İŞKUR), 2024a; Turkish Employment Agency (İŞKUR), 2024b; Republic of Türkiye Ministry of Labor and Social Security, 2024; Republic of Türkiye Ministry of Industry and Technology, 2022). From the analytical perspective adopted in this dissertation, however, access to these opportunities may remain shaped by occupational position, educational background, financial resources, professional networks, and technological infrastructure.

The training, reskilling, and lifelong-learning mechanisms discussed above can play an important role in labor market transitions (Turkish Employment Agency (İŞKUR), 2024a; Vocational Qualifications Authority (MYK), 2024; Republic of Türkiye Ministry of Labor and Social Security, 2024). A comparative reading of the reviewed documents nevertheless suggests that their predominant focus on skills acquisition gives less attention to how the responsibilities, costs, and risks of adaptation may be distributed among workers, employers, and public institutions. This distinction is important for the present analysis because workers do not necessarily enter technological transformation from equal starting positions or possess equal access to the resources required for adaptation.

Uneven adaptation is also spatial and sectoral. Differences in institutional capacity, industrial infrastructure, organizational resources, and training provision mean that workers and firms may benefit differently across regions and industries. This is particularly relevant to the food industry, where technologically advanced production environments coexist with more labor-intensive structures and firms vary in their production capacity, innovation capability, and organizational resources (Republic of Türkiye Ministry of Industry and Technology, 2024c). Such heterogeneity means that workers can encounter automation under substantially different technological and organizational conditions.

From a Sociology of Expectations perspective, these differences matter because policy narratives often anticipate that technological modernization will bring widely shared benefits. Presenting digital transformation as necessary for growth, innovation, and competitiveness may leave less attention to who has the resources and support to adapt. Expectations do not merely describe possible futures; they shape present priorities, investments, and institutional interventions (Borup et al., 2006). Examining who is expected to adapt, under what conditions, and with what resources therefore becomes a central analytical question.

These inequalities are directly relevant to the dissertation's comparison of blue-collar, white-collar, and managerial accounts, which examines how automation and adaptation expectations are experienced from different positions within the labor process.

1.5.1.4 Policy Framing of Food Industry Transformation

The reviewed policy documents position the food industry as a strategically important area for industrial modernization because of its contribution to employment, production, exports, and food security. Turkey's position among the world's leading agricultural producers is presented as providing opportunities for expanding value-added food production and export-oriented development. Within this framing, strengthening productivity, technological capabilities, and international competitiveness becomes a central policy objective for the sector (Republic of Türkiye Ministry of Industry and Technology, 2024c).

Technological upgrading is presented as an important mechanism for achieving these objectives. Automation, robotics, artificial intelligence, sensor technologies, data-driven monitoring, and smart production systems are associated with improved efficiency, quality control, resource utilization, and competitiveness (Hassoun et al., 2023; Republic of Türkiye Ministry of Industry and Technology, 2024c). Policy narratives also connect digital transformation with sustainability, waste reduction, compliance with increasingly demanding quality standards, and greater integration into global value chains. The anticipated transformation of the sector is therefore framed in both economic and environmental terms.

At the same time, the policy documents acknowledge structural constraints affecting this transformation, including limitations in R&D expenditure, innovation capacity, technological readiness, and access to financial and organizational resources. Collaboration among firms, universities, and research institutions is consequently presented as an important mechanism for strengthening sectoral innovation (Republic of Türkiye Ministry of Industry and Technology, 2024c). Nevertheless, the emphasis remains primarily on how technological upgrading can improve the sector's productivity, sustainability, and competitive position.

A comparative reading of the documents reviewed for this dissertation suggests that the labor implications of the anticipated transformation receive less detailed attention than its economic and technological dimensions. Although technological modernization is expected to alter production practices and skill requirements, these documents generally provide more extensive discussion of productivity, competitiveness, innovation, and sustainability than of changing labor processes, job quality, workplace experiences, or differences among occupational groups (Republic of Türkiye Ministry of Industry and Technology, 2024c; Republic of Türkiye Ministry of Labor and Social Security, 2024; Turkish Employment Agency (İŞKUR), 2024a). Workforce adaptation is generally addressed through training, reskilling, and the development

of technological competencies rather than through detailed consideration of how automation may be experienced across different positions within food-production workplaces.

From a Sociology of Expectations perspective, this policy framing constructs technological transformation as a necessary pathway toward a more productive, sustainable, and internationally competitive food industry. These expectations help define the technologies, competencies, and institutional collaborations considered necessary for the sector's future development (Republic of Türkiye Ministry of Industry and Technology, 2024c; Republic of Türkiye Ministry of Labor and Social Security, 2024; Turkish Employment Agency (İŞKUR), 2024a). However, policy documents alone cannot establish how these anticipated futures are interpreted by managers or experienced by workers. Comparing this policy-level vision with managerial and worker accounts therefore enables the dissertation to examine where expectations concerning technological upgrading and workforce adaptation converge and where tensions emerge.

1.5.1.5 Policy Narratives and Expectations of the Future

Across the reviewed policy documents, technological transformation is presented not merely as a set of economic or industrial policies but also as a future-oriented vision for national development. Digitalization, innovation, entrepreneurship, workforce adaptation, sustainability, and competitiveness are consistently framed as essential components of Turkey's future trajectory. In this sense, policy documents actively construct expectations regarding how industries, institutions, firms, and workers should prepare for Industry 4.0 (Republic of Türkiye Ministry of Industry and Technology, 2024a; Turkish Employment Agency (İŞKUR), 2024a; Republic of Türkiye Ministry of Industry and Technology, 2022).

A comparative reading of the reviewed documents suggests that technological transformation is frequently framed as a necessary and desirable pathway toward economic modernization. Digital technologies, automation systems, artificial intelligence, and innovation ecosystems are frequently portrayed as key drivers of productivity, competitiveness, and sustainable growth. Future economic success is therefore closely associated with the ability of firms, industries, and institutions to embrace technological change and integrate Industry 4.0 principles into their operational practices (Turkish Employment Agency (İŞKUR), 2024a; Republic of Türkiye Ministry of Industry and Technology, 2024c).

The future-oriented nature of these policy narratives becomes particularly visible in documents such as the *13th Labor Assembly Report (2024)*, where digital transformation is associated with the vision of “a brighter future for work.” Such narratives portray technological change as a

pathway toward increased prosperity, productivity, and social development while encouraging institutions and individuals to prepare for anticipated transformations. From a Sociology of Expectations perspective, these visions do not merely describe possible futures but actively contribute to constructing desirable futures that guide present policy priorities, investments, and workforce strategies (Republic of Türkiye Ministry of Labor and Social Security, 2024).

The reviewed documents also construct a future in which adaptation becomes a shared responsibility among workers, educational institutions, firms, and public authorities. Within this framework, reskilling, upskilling, lifelong learning, entrepreneurship, and digital competencies are presented as key mechanisms through which individuals are expected to adapt to technological transformation and contribute to national development (Republic of Türkiye Ministry of Labor and Social Security, 2024; Turkish Employment Agency (İŞKUR), 2024a; Republic of Türkiye Ministry of Industry and Technology, 2022).

In parallel, many of the reviewed documents promote an inclusive vision of technological transformation. Policy initiatives addressing women's employment, youth participation, vocational training, and regional development suggest an expectation that the benefits of technological modernization can be broadly shared across society (Turkish Employment Agency (İŞKUR), 2024a; Turkish Employment Agency (İŞKUR), 2024b; Çalışma Genel Müdürlüğü (CGM), 2024). Such narratives position technological transformation not only as an economic objective but also as a mechanism for social development and national progress. From a Sociology of Expectations perspective, these narratives are significant because expectations are not neutral descriptions of the future but performative forces that shape present actions, policy priorities, institutional investments, and organizational strategies (Borup et al., 2006). By repeatedly emphasizing innovation, digitalization, workforce adaptation, entrepreneurship, and competitiveness, policy documents contribute to legitimizing particular visions of the future while directing resources and attention toward specific developmental pathways. This dynamic is evident in initiatives designed to attract highly skilled talent, strengthen international innovation networks, support entrepreneurship, and develop qualifications for emerging digital occupations. However, the Sociology of Expectations cautions against treating these anticipated futures as predetermined outcomes. Although expectations can mobilize resources and coordinate collective action, their realization depends on institutional capacities, organizational practices, economic conditions, and the ways workers and employers respond to technological change.

This perspective is particularly relevant to the present dissertation. While policy documents articulate ambitious expectations regarding automation, technological development, and

workforce adaptation, the extent to which these expectations are shared, challenged, or reinterpreted by workers and managers remains an empirical question. By examining the experiences and future expectations of blue-collar workers, white-collar employees, and managers within Turkey's food industry, this dissertation explores how policy narratives surrounding Industry 4.0 are interpreted, negotiated, and experienced in everyday workplace settings.

1.5.1.6 Relevance for This Dissertation

The policy review establishes the national context within which technological modernization and workforce adaptation are envisioned in Turkey, but policy documents alone cannot establish how these expectations are interpreted within particular organizations or experienced in workplaces. This dissertation addresses that empirical gap by examining how blue-collar workers, white-collar employees, and managers in Turkey's food industry perceive and negotiate automation under different organizational conditions. Drawing on the Sociology of Expectations, it connects policy narratives with organizational strategies and workplace experiences without treating policy visions as objective predictions or evidence of implementation outcomes.

2. Literature Review

This chapter reviews the bodies of literature that ground the dissertation conceptually and empirically. It situates the study within scholarship on the new technologies and automation systems associated with Industry 4.0, with particular attention to their implications for workforce dynamics. By bringing these strands together, the chapter establishes the analytical basis for the research questions and identifies the gaps addressed by the dissertation.

The review brings together theoretical discussions and empirical research. First, the theoretical literature clarifies the principal concepts and debates informing the study. It distinguishes broader accounts of the Fourth Industrial Revolution from the technological and organizational transformations associated with Industry 4.0, outlines the main components of contemporary automation, and introduces sociological perspectives, most notably the Sociology of Expectations for examining how future-oriented narratives may shape technological adoption and the positioning of labor. Second, the empirical literature reviews evidence from global and country-specific studies, with particular attention to developing-economy contexts and Turkey's manufacturing and food-production sectors. It examines how automation may reconfigure jobs, skills, working conditions, and organizational strategies under differing sectoral and institutional conditions.

Accordingly, Section 2.1 discusses the theoretical literature, Section 2.2 reviews the empirical literature, and Section 2.3 synthesizes the main findings and identifies the unresolved questions that motivate the present research. This structure places the dissertation within the wider academic discussion while establishing the need for a sector-specific analysis of labor, automation, and policy narratives in selected settings within Turkey's food-production sector.

2.1 Theoretical Literature

Technological change has long occupied a central position in social-scientific debates because it affects not only production technologies but also labor processes, organizational structures, and wider social relations. Within this literature, the Fourth Industrial Revolution (4IR) refers to a broad narrative of socioeconomic transformation associated with digitalization and technological convergence, whereas Industry 4.0 more specifically concerns the integration of interconnected, digital, and increasingly automated systems within industrial production (Kagermann et al., 2013; Yüksekbilgili & Çevik, 2018). This distinction allows the dissertation to separate wider claims about societal transformation from changes occurring within manufacturing and work organization.

The consequences of these technologies cannot be inferred from their technical capabilities alone. Technologically deterministic interpretations may overlook the institutional, political, and organizational conditions through which technologies are selected, implemented, and experienced (Marx, 1997; Dafoe, 2015). Automation may improve productivity and production flexibility, reorganize tasks, or complement particular human capabilities, while also generating risks related to displacement, changing skill requirements, job quality, and unequal access to adaptation opportunities (Autor, 2015; Brynjolfsson & McAfee, 2014). The distribution of these outcomes depends partly on organizational decisions, institutional arrangements, and the forms of training and support available to different groups of workers. The Sociology of Expectations provides the principal theoretical framework through which this dissertation examines these processes. Expectations about efficiency, competitiveness, employment, and technological progress are not treated merely as predictions. They may shape policy priorities, investment decisions, organizational strategies, and workforce responses in the present (Brown & Michael, 2003; Borup et al., 2006). This perspective enables Industry 4.0 to be examined as both a technological transformation and a field in which different actors construct, promote, translate, or challenge anticipated futures.

These questions are examined within selected company settings in Turkey's food-production sector, where labor-intensive processes coexist with varying levels of technological adoption and sector-specific requirements concerning quality, hygiene, safety, and raw-material variability (Kaya et al., 2010; Yılmaz, 2016). The following sections therefore clarify the technological foundations of Industry 4.0, review debates concerning automation and labor, and develop the Sociology of Expectations framework used to connect policy narratives, organizational strategies, and workers' experiences.

2.1.1 The Concept of New Automation Systems and Industry 4.0

Historically, industrial revolutions have reshaped production systems, labor relations, and broader social structures through successive waves of technological change. The First Industrial Revolution introduced mechanised production based on steam power, while the Second expanded mass production through electricity, assembly lines, and new energy sources. The Third Industrial Revolution was associated with electronics, information technologies, industrial automation, and digital communication, which contributed to new forms of work organization and increasingly information-intensive production processes (Günaydın, 2018; Pamuk & Soysal, 2018; Johannessen, 2018). These transformations provide an important historical background for understanding Industry 4.0. However, the central concern of this

dissertation is not the historical development of industrial revolutions itself, but the contemporary relationship between automation, labor, and expectations in Turkey's food-production sector.

Building on the digitalisation processes associated with the Third Industrial Revolution, Industry 4.0 refers to the integration of cyber-physical systems, the Internet of Things (IoT), artificial intelligence (AI), big-data analytics, robotics, and interconnected intelligent systems within industrial production (Ötleş & Özyurt, 2016; Nakayama et al., 2020; Kumar et al., 2021). It therefore involves more than the introduction of individual machines or the further mechanisation of isolated production tasks. It describes the increasing integration of physical production processes with digital monitoring, data exchange, and automated or semi-automated forms of control and decision-making.

In this dissertation, the term new automation systems is used to refer collectively to the interconnected digital, robotic, and data-driven technologies associated with this transformation. The term includes both advanced technological systems and their application to particular production processes. It does not imply that these systems are entirely autonomous or uniformly implemented. Their characteristics and levels of integration may vary between companies, production units, and tasks.

A central feature of Industry 4.0 is the capacity of machines, production units, and information systems to exchange data through digital networks. This connectivity can support decentralised control and allow production systems to respond more flexibly to changing operational conditions (Kagermann et al., 2013; Rana & Rathore, 2023). Applications associated with digitally integrated production include real-time monitoring, data-supported decision-making, predictive maintenance, and more flexible adjustment of production processes (Kagermann et al., 2013; Tavera Romero et al., 2021). These developments may increase production flexibility and adaptability, although their implementation depends on the technological, financial, and organizational capacities of particular firms.

The integration of these systems also has implications for the organization of work. As firms introduce automated and data-driven production technologies, some employees may be expected to operate, monitor, maintain, or work alongside new systems. The resulting skill requirements and training needs depend on how technologies are introduced and how responsibilities are distributed within particular workplaces (Kumar et al., 2021). Workforce

development and continued learning are therefore relevant to Industry 4.0, but their availability and effects should not be assumed to be uniform across employees or organisations.

Industry 4.0 may offer opportunities for productivity, flexibility, and process innovation, while also raising questions concerning workforce adaptation, skill mismatches, unequal access to training, and the possible displacement or reorganization of particular tasks. These possibilities demonstrate that technological transformation is not solely a technical process but is also shaped by organizational decisions and institutional conditions. Its implementation and workforce consequences therefore depend not only on technological investment but also on how technologies are selected, introduced, and integrated into existing production and labor structures (Erer & Erer, 2020). The following section examines the principal technological components through which these forms of integration are commonly discussed.

2.1.2 Key Technological Components of Industry 4.0

The term Industry 4.0 gained prominence following its presentation at the Hannover Fair in 2011 and subsequently became associated with strategies for integrating digital technologies into industrial production (Şener & Elevli, 2017). As discussed in the previous section, Industry 4.0 seeks to connect physical production processes with digital monitoring, communication, and control. Its frequently stated objectives include increasing production flexibility, improving efficiency, and reducing costs through the reorganization of production processes (Mohamed, 2018).

Industry 4.0 is commonly described through a set of interconnected technological components rather than a single technology. Drawing on one such classification, Gedik (2021) identifies cyber-physical systems, horizontal and vertical system integration, the Internet of Things (IoT), artificial intelligence, big-data analytics, cloud computing, augmented reality, cybersecurity, and additive manufacturing as principal components of Industry 4.0. Other classifications may group or label these technologies differently; therefore, they should not be understood as a universally fixed set of nine elements. Together, they illustrate the combination of physical machinery, digital infrastructure, connectivity, and data-processing capabilities associated with contemporary industrial automation.

These components perform distinct but interrelated functions. Cyber-physical systems connect physical production processes with computational monitoring and control, while the IoT enables machines, sensors, and other devices to exchange data through digital networks. Big-data analytics and artificial intelligence can support the interpretation of production data and

assist operational decision-making. Cloud computing provides infrastructure for storing and accessing data, whereas cybersecurity is concerned with protecting increasingly interconnected systems. Horizontal and vertical integration connects information across different stages and organizational levels of production. Augmented reality may assist activities such as maintenance, training, and process guidance, while additive manufacturing enables objects or components to be produced directly from digital models. Their specific functions and levels of application nevertheless vary across industries, firms, and production processes.

Rather than operating independently, these technologies may be combined within broader production systems that support real-time data exchange, process monitoring, automated control, and coordination across different organizational functions. Their integration can contribute to greater flexibility, efficiency, and product customisation, although these outcomes depend on how the technologies are selected and implemented within particular production environments (Santos et al., 2018; Yüksekbilgili & Çevik, 2018). The presence of an individual technology should therefore not automatically be equated with the comprehensive implementation of Industry 4.0.

These technologies matter for workers and managers because their introduction may change who does which tasks, what skills are needed, what managers are responsible for, and how employees work with production systems. However, such consequences cannot be inferred from the technologies alone; they also depend on organizational choices, workplace conditions, workforce preparation, and institutional support. The following section therefore moves from the technological components of Industry 4.0 to the wider debate concerning automation and the future of work.

2.1.3 Automation and the Future of Work

While Industry 4.0 is frequently discussed in terms of technological innovation, its broader significance also lies in its implications for labor markets, employment structures, and the organization of work. The introduction of automation, artificial intelligence, robotics, and data-driven production systems has generated extensive debate concerning the future of work, the quality of employment, and the changing relationship between workers and technology. These debates do not point towards a single predetermined outcome. Instead, they offer competing explanations of how technological change may substitute for, complement, or reorganise human labor.

Industry 4.0 is associated with efforts to improve productivity, efficiency, production quality, and process flexibility through rapidly developing technological capabilities (Soylu, 2018). Artificial intelligence, robotics, and other forms of automation may improve the speed, consistency, and efficiency of selected production activities. At the same time, their diffusion may reduce demand for some categories of unskilled and lower-skilled labor, particularly where tasks are repetitive and readily automated (Badiuzzaman & Rafiquzzaman, 2020). These developments are often expected to contribute to productivity, economic growth, and welfare. However, the consequences of automation cannot be assessed solely in terms of technological performance or aggregate productivity. Technological adoption takes place within particular social, economic, organizational, and policy contexts. Consequently, its benefits and risks may be distributed unevenly among companies, occupational groups, and workers.

A central distinction in debates on automation concerns the substitution and complementarity of human labor. Technologies may substitute for workers when particular tasks can be codified, standardised, and performed predictably. At the same time, they may complement human capabilities by supporting decision-making, reducing physical demands, improving accuracy, or enabling employees to perform existing tasks differently. Susskind (2020) argues that technological change can operate through both mechanisms: it may replace human labor in some tasks while increasing its value in others. Consequently, the effects of automation depend not only on technological capabilities but also on how tasks and responsibilities are reorganised within production systems.

Brynjolfsson and McAfee (2012) similarly emphasize the potential complementarity between human and technological capabilities. Computers can perform many activities with speed, consistency, and accuracy, whereas people may retain comparative strengths in areas requiring contextual judgment, creativity, interpersonal understanding, and forms of knowledge that are difficult to codify. From this perspective, the central question is not simply whether humans or machines will perform a particular job, but how their different capabilities may be combined within changing work processes. Nevertheless, complementarity should not automatically be understood as an equal or beneficial partnership. Its consequences for employees depend on how tasks are allocated, whether workers receive appropriate training, how organizational authority is distributed, and who benefits from the resulting productivity gains.

This distinction is connected to the increasing use of task-based approaches in research on automation. Earlier studies and public debates often evaluated the automation risk of occupations as relatively unified categories. Frey and Osborne (2013), for example, estimated the susceptibility of occupations to computerisation and suggested that workers could

increasingly be reassigned to activities requiring creative and social intelligence. More recent task-based approaches emphasize that occupations consist of multiple activities that differ in their susceptibility to automation. Technological change may therefore replace or modify particular tasks without eliminating an occupation in its entirety. It may also create new responsibilities involving monitoring, maintenance, coordination, technological supervision, or problem-solving (Autor, 2015).

The task-based perspective also complicates the assumption that automation primarily threatens low-skilled employment while leaving high-skilled employment protected. Skill-biased technological change theories generally suggest that technological development increases demand for more highly educated or technically skilled workers while reducing opportunities for employees with fewer recognized skills. Routine-biased accounts provide a more differentiated explanation by proposing that technological susceptibility depends not only on the skill level associated with an occupation but also on whether its tasks are routine, repetitive, and codifiable (Autor, 2015). Technological change may consequently affect routine manual and cognitive activities while complementing some non-routine tasks. However, the boundaries of what can be codified or automated are not fixed and may change as technological capabilities develop.

Recent advances in generative artificial intelligence make this qualification particularly important. Automation is no longer discussed only in relation to repetitive manual work or routine administrative activities. Research by Vicsek et al. (2025) demonstrates that creative and knowledge-based occupations, including journalism and copywriting, are also undergoing substantial changes as a result of generative AI. Based on interviews with professionals in Hungary, their study indicates that generative AI was generally perceived as an efficiency-enhancing tool rather than as an immediate replacement for entire occupations. Nevertheless, its use changed task composition, professional roles, and expectations concerning future work. These findings suggest that creative and knowledge-intensive occupations should not be treated as inherently protected from technological change, even when AI primarily reorganises tasks rather than eliminating jobs.

The effects of automation on employment also depend on workers' opportunities to move between tasks and occupational roles. Mainstream economic approaches frequently present education, reskilling, and investment in human capital as mechanisms through which workers may adapt to technological change and emerging occupations. Means (2017), however, questions whether narrow human-capital approaches are sufficient to address technological displacement, precarity, and unequal opportunities for adaptation. From this perspective,

education and continued training may allow employees to develop capabilities that complement new technologies. However, the availability of training does not itself guarantee successful adaptation. Workers' opportunities are also shaped by their educational backgrounds, access to workplace learning, employment conditions, organizational support, and the transferability of their existing skills.

Concerns regarding unemployment and employment insecurity therefore remain central to the future-of-work debate. Technological change may reduce demand for certain tasks or occupational roles while simultaneously creating new skill requirements and forms of employment. Its effects cannot be reduced to direct technological displacement alone. Workers may also face unemployment or insecurity when job requirements change but they lack access to the resources needed to move into different roles (Duruel & Kara, 2010). Reskilling should therefore be understood not only as an individual responsibility but also as a process influenced by employers, educational institutions, labor-market structures, and public policy.

At the same time, empirical research cautions against interpreting digitalisation as a uniform process of rapid and large-scale job destruction. Drawing on evidence from Nordic labor markets, Rolandsson and Dølvik (2021) describe digital transformation as a process characterised by gradual adaptation and institutional continuity as well as disruption. Their findings suggest that although some manual and routine activities may decline, digitalisation also transforms job content, skill requirements, work organisation, and opportunities for workplace learning and upskilling. Although these findings cannot be transferred directly to other national or sectoral settings, they demonstrate that the consequences of automation depend not only on technological capabilities but also on labor-market institutions, public policies, worker participation, and organizational strategies.

This institutional perspective is particularly important because similar technologies may produce different workforce outcomes in different workplaces and national contexts. Companies may vary in their financial capacity, organizational readiness, training provision, and strategies for integrating workers into technological change. National vocational-training systems, employment protections, industrial policies, and opportunities for employee participation may also influence whether automation results primarily in displacement, task transformation, or human-machine complementarity. Technological capabilities therefore establish possibilities, but they do not independently determine how work will be reorganised or how employees will experience the transition.

The future-of-work debate also concerns more than the number of jobs created or displaced. Artificial intelligence and automation may affect not only the quantity of work but also its

quality and meaning. Technological change can alter employees' autonomy, workload, responsibilities, work rhythms, workplace relationships, and sense of professional value. These implications are particularly important because paid work can function not only as a source of income but also as a source of meaning, identity, and purpose (Susskind, 2023). Technologies that reduce physically demanding or repetitive activities may improve certain working conditions. Conversely, increased monitoring, machine-paced production, reduced control over tasks, or the declining recognition of existing expertise may introduce different forms of pressure. Employment retention should therefore not be interpreted as evidence that the character or quality of work remains unchanged. The effects of automation must consequently be considered in relation to both the availability of work and changes in the nature and quality of work (Susskind, 2020).

Overall, the literature does not support either a uniformly optimistic or a uniformly pessimistic interpretation of automation. Some perspectives emphasize productivity growth, the creation of new occupational activities, and human–machine complementarity, whereas others draw attention to displacement, skill polarisation, unequal opportunities for adaptation, and changes in job quality. Task-based approaches further demonstrate that these outcomes may occur simultaneously within the same occupation or workplace. Automation may remove some tasks, transform others, and create new responsibilities without necessarily resulting in the complete disappearance of a job. Its consequences are therefore shaped by the interaction of technological capabilities, task composition, organizational decisions, training opportunities, labor-market institutions, and policy support.

The uncertainty surrounding these outcomes also makes expectations analytically significant. Expectations concerning job displacement, productivity growth, skill shortages, employment security, or human–machine collaboration do not merely describe possible futures. They may influence present decisions regarding technological investment, workforce planning, training, and public policy. Different actors may construct competing expectations according to their positions, interests, and experiences, and these expectations may be revised as technologies encounter organizational, economic, or workforce-related limitations. The following section therefore introduces the Sociology of Expectations as a framework for examining how anticipated technological futures are constructed, communicated, mobilised, and reassessed by different actors.

2.1.4 The Sociology of Expectations and the Understanding of Technological Innovations

There are differing views on what the future world of work will look like and how rapidly technological transformations will unfold. In recent years, social science research has increasingly drawn attention to the role of expectations in shaping scientific and technological innovation. Scholars working within Science and Technology Studies (STS) argue that expectations are not merely predictions about the future but socially constructed representations that may influence technological development in the present (Brown & Michael, 2003; Borup et al., 2006). This perspective is particularly relevant to Industry 4.0, where visions of automation, artificial intelligence, and digital transformation increasingly shape policy priorities, organizational strategies, investment decisions, and debates about workforce adaptation.

Technological change should therefore not be understood as an autonomous or purely technical process. Although technologies may transform production systems and working practices, their development and effects are mediated through human agency, institutions, organizational practices, and broader sociotechnical systems. Expectations influence which technologies attract investment and public support, which problems are prioritized by policymakers and firms, and which technological futures are perceived as desirable or necessary (Selin, 2008). They are consequently involved in the processes through which technological futures are imagined, legitimized, and pursued.

In this context, the Sociology of Expectations (SoE) provides a theoretical framework for examining how collective anticipations and future-oriented discourses influence innovation and circulate among policymakers, firms, managers, and workers (Brown & Michael, 2003; Borup et al., 2006). Expectations may mobilize resources, coordinate actors, support investment decisions, and guide policy and labor strategies. At the same time, they may generate disagreement, uncertainty, or disappointment when different actors anticipate conflicting futures or when technologies do not produce the expected outcomes (Konrad & Alvial Palavicino, 2017).

A central proposition of SoE is that expectations are performative. They do not simply describe possible futures but may contribute to producing them by influencing decisions made in the present. Promises concerning productivity, competitiveness, labor shortages, or technological leadership may, for example, justify research funding, investments in automation,

organizational restructuring, and changes in workforce planning (Borup et al., 2006). Expectations can therefore influence both the direction and pace of technological development.

Technological expectations may also operate through feedback processes. Initial enthusiasm can attract investment and institutional support, thereby reinforcing confidence in a technology and increasing the likelihood of its further development (Geels & Smit, 2000). Nevertheless, expectations do not necessarily produce the futures they promise. Borup et al. (2006) describe alternating cycles of hype and disappointment in which early technological promises mobilize attention, investment, and institutional support but may later generate disappointment when the organizational and cultural contingencies shaping technological development are underestimated. Expectations may therefore mobilize and coordinate innovation while also generating disappointment, misallocated resources, and reputational costs when promises are exaggerated (Borup et al., 2006).

Expectations are also temporally structured. Anticipations of the future are interpreted through experiences of the past and conditions in the present. Brown and Michael (2003) describe this relationship through “retrospecting prospects,” indicating that actors construct expectations of future technologies partly by interpreting earlier experiences of technological change. Workers who have experienced restructuring, job losses, or unsuccessful training initiatives may approach new automation projects differently from those who associate technological change with occupational mobility or improved working conditions. Expectations should therefore not be treated as fixed attitudes toward technology; they develop through actors’ experiences, institutional positions, and interpretations of previous transformations.

Industry 4.0 can accordingly be approached not only as a collection of technologies but also as an expectation-producing discourse. It connects technological development with broader visions of competitiveness, modernization, efficient production, and a digitally skilled workforce. This perspective makes it possible to examine who defines the desirable technological future, what kinds of workers are imagined within that future, and how particular organizational changes become presented as necessary or inevitable.

This expectation-producing dimension of Industry 4.0 can also be examined through the concept of sociotechnical imaginaries. Jasanoff and Kim (2015) define sociotechnical imaginaries as collectively held, institutionally stabilized, and publicly performed visions of desirable futures shaped by shared understandings of the forms of social life and social order attainable through scientific and technological advancement. From this perspective, policy

narratives surrounding Industry 4.0 do more than anticipate technological change. They may construct a normative vision in which technological modernization is connected to national competitiveness, industrial upgrading, productivity, and a workforce capable of adapting to digital transformation. The concept therefore draws attention not only to the technologies promoted in policy discourse but also to the workers, skills, institutions, and social arrangements imagined as necessary for realizing the proposed future.

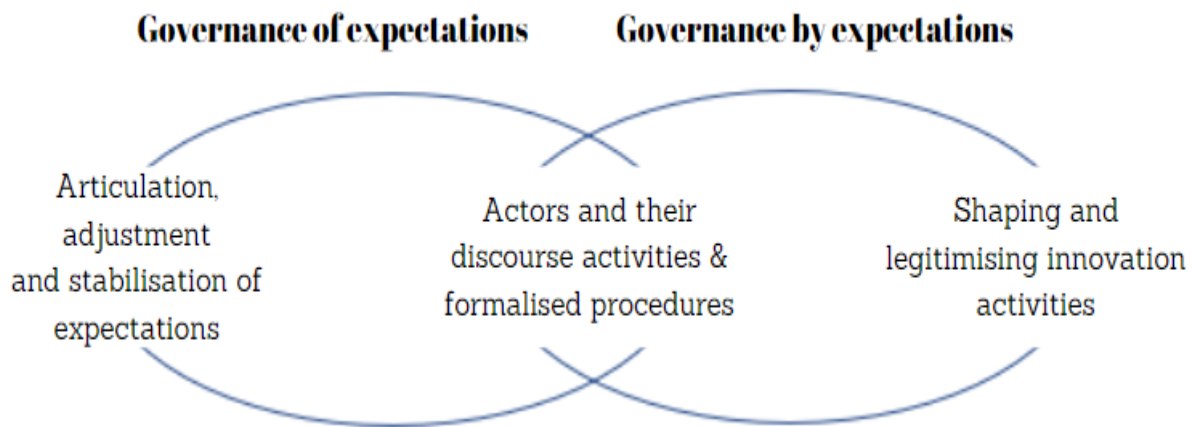
In this dissertation, sociotechnical imaginaries are examined primarily at the policy level, where visions of technological modernization and workforce adaptation are articulated and institutionally promoted. The analysis then considers how elements of these visions are translated into organizational strategies and how they correspond with, or differ from, the expectations and experiences of managers and workers. Sociotechnical imaginaries, expectation alignment, expectation conflict, and expectation translation are therefore used as related but analytically distinct concepts rather than as interchangeable categories. These terms are used in this study as relational analytical distinctions informed by the Sociology of Expectations framework, rather than as a set of fixed or formally established categories within the existing SoE literature.

2.1.4.1 Governance by and of Expectations in Industry 4.0

A fundamental distinction in SoE is between governance by expectations and governance of expectations (Konrad & Alvial Palavicino, 2017). Governance by expectations refers to how future-oriented visions guide decisions and coordinate action in the present. Industry 4.0 is frequently presented as a necessary response to global competition and productivity pressures, with corporate and governmental narratives promoting automation, digitalization, and artificial intelligence as strategies for maintaining competitiveness. Such narratives can shape policy decisions, corporate investment, research priorities, and workforce strategies (Geels & Smit, 2000; Pollock & Williams, 2010).

Governance of expectations, by contrast, concerns how technological visions are produced, selected, stabilized, contested, and revised over time (Borup et al., 2006). Expectations do not emerge independently of social actors. Policymakers, firms, technology providers, managers, workers, and labor organizations may promote or challenge different versions of the technological future. The governance of expectations therefore involves negotiation over which futures are considered credible, desirable, or attainable.

Figure 1. Governance of and by Expectations



Source: Konrad & Alvial Palavicino (2017).

This distinction makes it possible to examine both how expectations govern technological decisions and how expectations themselves are socially governed. Policymakers and firms may emphasize competitiveness, productivity, and modernization, while workers may interpret the same transformation through concerns about employment security, workload, occupational status, workplace control, or access to training. These positions should not automatically be treated as opposed: they may align, remain separate, or come into conflict depending on the institutional and organizational context.

For the purposes of this dissertation, these relationships are examined through expectation alignment, expectation conflict, and expectation translation. Expectation alignment refers to situations in which different actors develop sufficiently compatible understandings of a technological future to support coordinated action. A policy expectation of increased national competitiveness, a managerial expectation of improved efficiency, and workers' expectations of acquiring valuable skills may, for example, converge around support for automation. Alignment does not mean that these actors have identical interests, but that their expectations become sufficiently compatible to support technological or organizational change.

Expectation conflict occurs when actors construct competing futures around the same technological transformation. A policy vision of modernization or a managerial vision of productivity may conflict with workers' concerns about displacement, work intensification, or declining occupational autonomy. Such conflict is not merely a difference of personal opinion; it concerns which technological future should be pursued, who is expected to benefit, and how its risks and costs will be distributed.

Expectation translation refers to how future-oriented narratives acquire different meanings as they move between institutional and organizational levels. A policy commitment to workforce reskilling may be translated by managers into an expectation that employees should become more flexible and technically adaptable. Workers may subsequently interpret this expectation as an individual need to develop new skills to remain employable. Examining translation connects macro-level policy discourse with managerial practices and workers' interpretations without assuming that expectations pass unchanged between these levels.

2.1.4.2 Corporate Narratives and the Hype Cycle

Firms and industrial organizations play an important role in constructing and circulating automation-related expectations. Corporate narratives may present Industry 4.0 as an extensive or necessary technological transformation, emphasizing its potential to reduce costs, enhance productivity, and improve efficiency. From a Sociology of Expectations perspective, such narratives can be examined as promissory claims that mobilize organizational attention and resources while creating questions of accountability if promised outcomes are not realized (Brown, 2003). Such expectations may influence investment strategies, hiring practices, skill requirements, and workforce restructuring.

During the early stages of adoption, corporate discourses may emphasize the transformative potential of artificial intelligence, robotics, and automation. These expectations can mobilize organizational resources and create support for technological investment (Borup et al., 2006; Pollock & Williams, 2010). However, putting these expectations into practice does not necessarily follow the course firms initially anticipate. Technologies are introduced into existing organizations with established production routines, skill structures, managerial practices, and employment relations.

As implementation proceeds, firms may encounter technical failures, integration problems, workforce concerns, unexpected costs, or inefficiencies that were not fully anticipated (TÜSİAD, 2016). Such experiences may lead organizations to revise their technological strategies and expectations. The gap between promised transformations and actual implementation helps explain why innovation may involve alternating periods of enthusiasm and disappointment (Konrad, 2006; Konrad & Alvial Palavicino, 2017).

Corporate expectations should therefore not be treated only as accurate or inaccurate forecasts. They may legitimize investment, mobilize employees, justify restructuring, or define the skills considered necessary for the future workplace. SoE allows these narratives to be examined as

part of the social production of technological change rather than as neutral descriptions of an externally determined transition (Borup et al., 2006).

2.1.4.3 Worker Expectations: Uncertainty, and Adaptation

Workers are not passive recipients of policy and corporate expectations. They interpret, negotiate, and sometimes challenge automation-related narratives through their occupational positions, experiences, and anticipated futures (Brown & Michael, 2003). Their expectations may involve both optimism and anxiety, and these orientations may coexist within the same occupational group or individual.

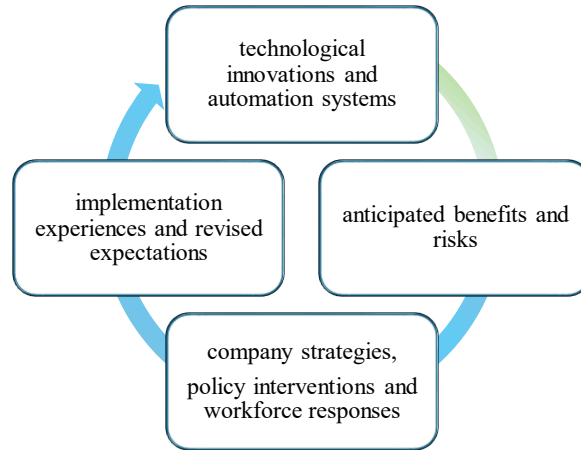
Existing research suggests that workers' perceptions and expectations regarding technological change may vary according to task composition, educational background, occupational position, access to training, perceived exposure to displacement, and previous experiences of workplace transformation (Trenerry et al., 2021). Employees performing repetitive or standardized tasks may perceive greater risks of task substitution or deskilling (Autor, 2015). However, these expectations should not be generalized to all blue-collar workers, since automation may also reduce physically demanding activities, improve safety, or create opportunities to acquire technical competencies (TÜSIAD, 2016). Access to training and perceived organizational support may therefore shape employees' acceptance of and attitudes toward technological change (Trenerry et al., 2021).

Similarly, white-collar workers should not be assumed to experience automation only as an opportunity for skill development. Some may expect technologies to complement their existing knowledge, while others may anticipate intensified monitoring, changing professional roles, or the automation of cognitive and administrative tasks. Differences between workers therefore cannot be reduced to a uniform distinction between blue- and white-collar employment. They should be examined in relation to tasks, organizational positions, learning opportunities, and previous experiences of technological change. From a Sociology of Expectations perspective, these experiences and institutional positions may shape how actors construct and interpret anticipated technological futures (Borup et al., 2006).

Worker expectations may align with managerial narratives when employees associate automation with improved working conditions, organizational survival, or occupational development. They may conflict with these narratives when workers anticipate job loss, reduced autonomy, work intensification, or unequal access to new opportunities. Expectations may also be translated into individual responses, including participation in training, efforts to

develop technical skills, resistance to new systems, or attempts to reposition oneself within the organization.

Figure 2. The Cycle of Technological Innovation and Expectation



Source: Author's own elaboration (2022).

Figure 2 illustrates how future-oriented narratives influence present decisions and technological implementation, while experiences arising during implementation may reinforce, challenge, or modify earlier expectations. Expectations can therefore shape how technologies are introduced, while experiences of using them can change what people expect next.

In conclusion, the Sociology of Expectations provides the primary theoretical lens for examining Industry 4.0 transformations in Turkey's food industry. It enables the study to move beyond the question of what automation does to employment and investigate how technological futures are constructed, circulated, negotiated, and experienced by different actors. Policy documents may construct visions of competitiveness and modernization; managers may translate these visions into expectations concerning efficiency, skills, and workforce organization; and workers may interpret them through their experiences of security, adaptation, autonomy, and occupational change.

The analysis therefore examines the performativity, alignment, conflict, and translation of expectations across policy, organizational, and worker levels. It also considers how earlier experiences of technological and organizational change inform present expectations of the future. Rather than presuming that policymakers, managers, blue-collar workers, or white-collar workers hold uniform positions, the dissertation investigates when their expectations converge, when they compete, and how their meanings change as they circulate between institutional levels. In this way, SoE connects macro-level policy and technological narratives with organizational strategies and workers' everyday experiences in Turkey's food industry.

2.2 Empirical Literature

This section reviews empirical studies, comparative reports, and applied literature on how Industry 4.0 technologies and automation systems affect workforce dynamics, production processes, and organizational practices. It focuses on how technological change reshapes labor structures, job roles, skill requirements, and business strategies, with particular attention to developing-country contexts and Turkey's food sector.

The literature reviewed for this dissertation suggests that important gaps remain regarding workers' own perspectives, particularly in labor-intensive sectors such as food production. Many of the studies reviewed here emphasize technological adoption, productivity, competitiveness, and anticipated employment effects. Comparatively less attention is paid to how workers experience and interpret automation, how companies manage workforce adaptation in practice, and how state policies are translated into organizational strategies and workplace-level changes. Moreover, these dimensions are often examined separately. This dissertation addresses this gap by bringing together workers' experiences, corporate strategies, and government policies within the context of Turkey's food industry.

2.2.1 Global Perspectives on Automation and Labor

Empirical studies, comparative reports, and conceptual reviews of Industry 4.0 indicate that automation, artificial intelligence, and robotic systems are reshaping workforce demands, job roles, and business models across sectors (Erer & Erer, 2020). These transformations may create new occupations and contribute to higher productivity, while also raising concerns about unemployment, skill mismatches, and the unequal distribution of technological risks and opportunities. The labor-related consequences of automation are therefore shaped not only by technological capabilities but also by market conditions, institutional arrangements, employer strategies, and workers' access to training and adaptation opportunities.

Şener and Elevli (2017) emphasize that Industry 4.0 increases demand for flexible and versatile workers who can adapt to changing technologies rather than specialize narrowly in a single task. Their argument highlights the growing importance of education and training mechanisms capable of preparing workers for evolving technological and occupational requirements (Şener & Elevli, 2017). From this perspective, workforce adaptability becomes a central condition shaping who can benefit from technological transformation and who may become vulnerable to its effects.

Some studies suggest that technological innovation may increase labor demand under certain conditions. Ekinçi (2013) argues that process innovations can reduce production costs and prices, expand product demand, and increase production volume, potentially creating additional employment. This perspective indicates that the employment effects of automation are not necessarily direct or linear but depend on market expansion, firm strategies, and the organization of production (Ekinçi, 2013).

Other studies emphasize the risks associated with technological transformation. As automation and artificial intelligence become more widespread, demand for some forms of low-skilled labor may decline. In the absence of adequate policy responses and training opportunities, this may contribute to unemployment, income inequality, and social exclusion (Çelik et al., 2018; Çeliktaş et al., 2015). These findings draw attention to the possibility that the costs and benefits of technological change may be distributed unevenly across occupational and social groups.

Evidence from Nordic labor markets presents a more nuanced pattern. Rolandsson and Dølvik (2021) argue that digitalization has not so far resulted in massive job destruction in Nordic countries. Instead, it has been characterized by gradual adaptation, occupational restructuring, and institutional continuity. Although some manual and routine jobs have declined, digitalization has also altered job content, skill requirements, workplace organization, and opportunities for upskilling. Their findings demonstrate how worker participation, training systems, institutional arrangements, and organizational strategies can mediate the labor-market effects of technological transformation (Rolandsson & Dølvik, 2021).

Petekçi (2021) similarly identifies both opportunities and challenges arising from Industry 4.0. Potential benefits include increased productivity, resource efficiency, innovation, and changing demand for skills. At the same time, technological transformation may contribute to unemployment, inequality, technological exclusion, cybersecurity risks, and an unequal distribution of automation's benefits. These implications extend beyond technological efficiency and concern the wider organization of work, social protection, and labor relations (Petekçi, 2021).

Table 2. The advantages and disadvantages of Industry 4.0

Advantages	Disadvantages
Increased value given to people in the production process	Danger of layoffs for blue-collar workers

Transformation of need for manpower from labor to intelligence	Legal processes created by layoffs are challenging for companies
Increased need for qualified experts in the market	Technological discrimination and exclusion
Increased resource efficiency	No taxation from robots, thus straining social security institutions
Providing energy savings	Income inequality within society reaching more extreme levels
Providing minimum cost and efficient production	Extra burden on the state with increasing unemployment
Encouraging companies to adapt to modern technologies	Lack of sufficient financing for small and medium-sized enterprises to purchase new technologies
Real-time production phase	Monopolization is becoming more prevalent
Providing innovative marketing techniques in a digital environment	Difficulty in finding qualified personnel
Systematic changes in work organization	Increasing importance of individualization
The increase in the tendency of individuals to establish their own businesses	Decrease in unionization
Customers' direct involvement in the design process	Increased conflict between customer and manufacturer
Easy integration into global changes	Difficulty in selecting quality information from the mass
Serious breakthroughs in cybersecurity	Companies allocate large funds to security resources
Reduction in human-related work accidents	Emergence of unexpected and costly robotic accidents
Making more equitable and efficient decisions in hiring	Ignoring the human aspect in hiring

Source: Petekçi (2021).

Taken together, these studies do not support a single deterministic conclusion about whether automation simply creates or eliminates employment. Rather, they indicate processes of task substitution, job creation, occupational restructuring, and changing skill requirements whose outcomes vary across institutional and organizational contexts. The relevant empirical question is therefore not only whether automation affects labor, but how its effects are mediated by training systems, organizational support, worker participation, and institutional protection.

2.2.2 Automation and Labor Issues in Developing Countries

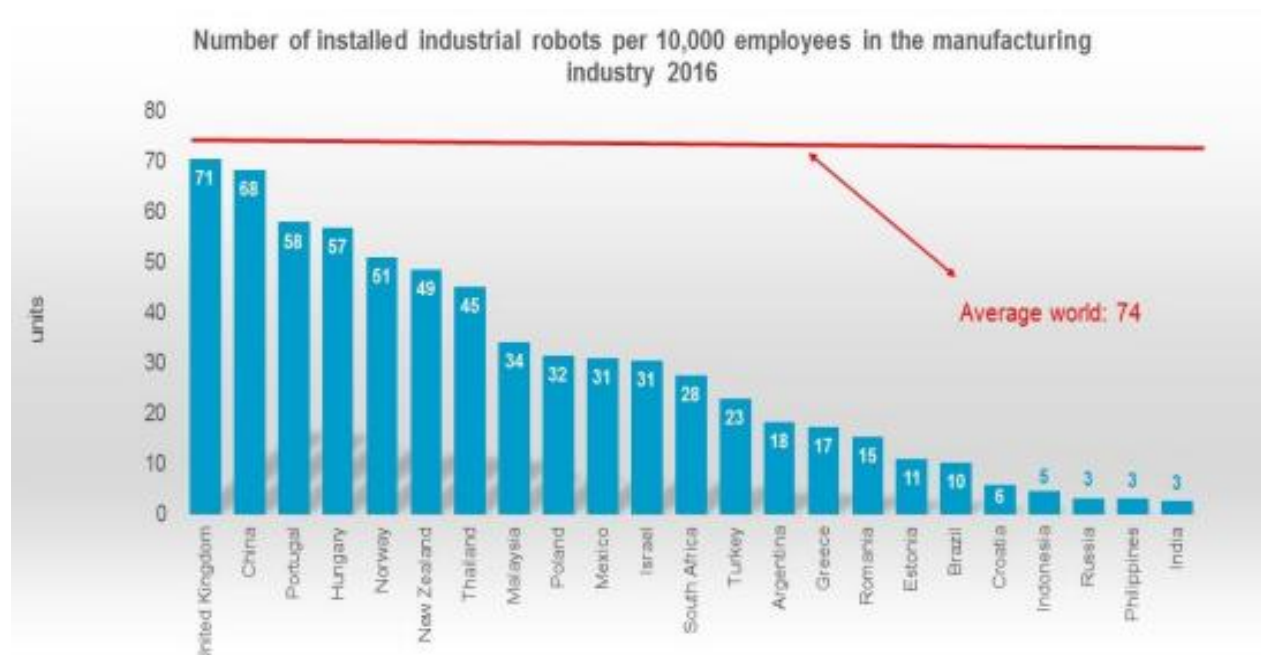
Developing countries occupy a distinctive position within debates on automation and Industry 4.0. Technological transformation may support productivity growth, competitiveness, and industrial upgrading, but it also raises concerns about employment, skill development, and technological dependency. Its effects may differ considerably from those observed in developed economies because of variations in labor costs, industrial structures, educational systems, infrastructure, and technological capacity.

The relationship between technology and the workforce is therefore complex and dynamic, particularly in food production. Automation and robotic systems combined with integrated digital process control may reduce processing costs, improve food quality and safety, increase

production efficiency, and reduce energy consumption and food waste (Paoli, 2020). However, the reorganization of production through these systems also raises questions about employment, workforce responsibilities, and the skills required within new production arrangements.

Historical data reported by the International Federation of Robotics provide a comparative baseline for examining cross-country differences in industrial automation. The 2016 figures presented in Figure 3 show that robot density varied substantially across countries and that Turkey remained below several leading industrial economies at that time (International Federation of Robotics, 2018; Özdemir & Güneren, 2019). These figures are used as a historical comparison and should not be interpreted as representing the current level of industrial robot adoption.

Figure 3. Industrial Robots per 10,000 Manufacturing Employees by Country, 2016: A Historical Comparison



Source: International Federation of Robotics (2018), as presented in Özdemir and Güneren (2019).

Developing countries consequently face a double challenge. Technological upgrading may be necessary to maintain international competitiveness, while rapid automation may place pressure on employment models that depend on relatively low labor costs. As firms become less dependent on inexpensive labor and place greater emphasis on technological capacity and innovation, automation may alter the competitive advantages traditionally associated with low-wage production (Alçın, 2016; Doğru & Meçik, 2018; Frey & Osborne, 2016). More broadly,

countries whose manufacturing sectors begin to contract before reaching high income levels may face what Rodrik (2016) describes as “premature deindustrialization.”

These findings make workforce reskilling, social protection, and inclusive technological transition especially important in developing-country contexts. They also show that experience from highly industrialized countries cannot be transferred directly to developing economies without considering differences in industrial capacity, labor-market institutions, firm size, and access to technological and educational resources.

2.2.3 Automation in Turkey: Labor, Business Strategies, and Policies

Studies of Turkey indicate both opportunities and constraints in adapting to Industry 4.0. The country’s strategic location and relatively competitive production costs provide advantages within global manufacturing networks. However, limitations in technological capacity, workforce skills, and innovation infrastructure may slow or unevenly distribute technological transformation (Koca & Tanas Karagöl, 2023; TÜSİAD, 2016). Consequently, Turkish industrial policies increasingly emphasize digital transformation, automation, innovation, and workforce development as key priorities for maintaining international competitiveness.

The 2021 report of the Turkish Ministry of Family, Labor and Social Services examines the relationship between technology and employment within broader cultural, political, and economic transformations. It emphasizes workforce adaptability, institutional responsiveness, and lifelong learning as important components of managing technological change. The report also stresses the need for coordination between technological innovation, labor-market policies, and workforce development programs to support more inclusive adaptation to Industry 4.0 (Turkish Ministry of Family, Labor and Social Services Strategy Development Presidency, 2021).

However, companies do not possess equal capacity to respond to these policy and market expectations. The adoption of new technologies varies across firms and sectors. Large-scale companies generally have greater financial and technological resources to invest in automation and digital transformation, while smaller and family-owned enterprises face more substantial barriers. Within Turkey’s food industry, technological developments have been particularly visible in sub-sectors such as canned food, frozen food, fruit and vegetable processing, poultry, pasta, biscuits, and confectionery (Kaya et al., 2010). Technological transformation in the sector is therefore uneven, with adoption shaped by firm size, production capacity, sub-sector, and access to investment resources.

In its 2016 Industry 4.0 transformation framework, TÜSİAD identified six pilot sectors according to their technological potential, employment capacity, economic importance, and position within supply chains. These sectors were automotive, food and agriculture, white goods, machinery systems, textiles, and chemicals (TÜSİAD, 2016). Table 3 presents this classification as a historical snapshot of how the economic significance of selected sectors was framed in the report; it is not intended to represent their current economic contribution.

Table 3. Historical Snapshot of the Contribution of Six Pilot Industry Sectors to the Turkish Economy, Based on TÜSİAD (2016)

	Share in value-added	Share in employment	Increase in total factor productivity	The ratio of exports to imports	The ratio of imports to exports
Automotive Industry	12%	6%	7%	0.9	0.9
White goods industry	3%	1%	9%	0.9	0.7
Machinery Systems Industry	5%	5%	5%	0.9	0.6
Textile Industry	8%	13%	-0.5%	1	2.4
Food and Agriculture Industry	10%	12%	-4%	0.9	1.9
Chemical Industry	5%	2%	1%	1	0.2

Source: TÜSİAD (2016).

The data indicate that food and agriculture occupy an important position within the Turkish economy in terms of both employment and value-added production. The sector's 12% share in employment, together with its labor-intensive structure and the reported 4% decline in total factor productivity figure in the table, makes it particularly relevant for examining the relationship between technological upgrading and workforce change.

According to TÜSİAD (2016), Industry 4.0 may replace some low-qualified personnel involved in production, quality, and maintenance activities. The report estimates that approximately 20–30% of these positions at particular points in the value chain could be affected in the long term. At the same time, automation may improve ergonomics by reducing physically demanding work. TÜSİAD also anticipates changes in the competencies required from both blue- and white-collar workers, as companies will need more qualified personnel to manage increasingly integrated production technologies (TÜSİAD, 2016).

Taken together, these policy- and industry-oriented narratives may be interpreted as contributing to an emerging sociotechnical imaginary in which Turkey's future competitiveness is associated with technological modernization, industrial upgrading, and the development of a digitally adaptable workforce (Jasanoff & Kim, 2015). However, the existence of such a policy vision does not demonstrate that it is uniformly accepted or implemented. How firms put this vision into practice depends on their resources and strategies, while managers and different groups of workers may understand its implications differently.

The Turkish literature therefore does not necessarily anticipate the complete elimination of labor. Instead, it points toward changes in task composition, skill requirements, occupational structures, and the distribution of opportunities and risks between groups of workers. Nevertheless, much of this literature remains focused on projected technological and economic outcomes. Less is known about how such projections are interpreted by managers and workers within firms or how national policy priorities are reflected in workplace-level adaptation. These issues are central to this dissertation.

2.2.4 Analysis of Technological Innovations and Automation in the Food Sector

Industry 4.0 technologies are frequently presented as instruments for improving efficiency, quality, and cost management throughout food production and supply chains. Technologies such as Internet of Things devices, artificial intelligence, machine learning, and robotic automation may contribute to production monitoring, quality control, traceability, and supply-chain management (Ötleş & Özyurt, 2016).

However, the integration of these innovations into the food sector is not limited to technical improvements. New technologies can alter organizational structures, task allocation, workforce roles, skill requirements, and company strategies alongside production processes. Automation in the food sector should therefore be examined as an organizational and labor-related transformation as well as a technological one (Petekçi, 2021).

From a Turkish perspective, the adoption of Industry 4.0 technologies involves particular opportunities, constraints, and uncertainties. The increasing importance of sensors, data processing, programming, and interconnected production systems is expected to generate demand for new technical competencies and corresponding changes in higher education and workforce preparation (Şener & Elevli, 2017). In the food sector, firms' ability to respond to these requirements may vary according to their financial, technological, and organizational capacities.

This tension is especially relevant in developing economies where firms may compete through relatively low labor costs. In such contexts, the economic incentives for automation may differ from those in highly industrialized economies. Yılmaz (2016) illustrates the historical importance attributed to relatively low production costs in Turkey, whereas Paoli (2020) identifies potential efficiency, quality, safety, and resource-use benefits associated with food-manufacturing automation. Considered together, these arguments point to a potential tension between competitiveness based on labor-intensive production and competitiveness pursued through technological upgrading.

State policies play an important role in shaping this process. Public policies may influence technological adoption through infrastructure provision, financial support, education, and workforce-development initiatives. As indicated by the policy documents reviewed in Chapter 1, however, the existence of supportive measures does not by itself establish that firms, regions, or workers possess equal capacity to access and benefit from them.

Automation may reduce physically demanding activities and improve certain working conditions while simultaneously changing skill requirements and generating uncertainty regarding future employment and occupational roles (TÜSİAD, 2016). These outcomes are not necessarily mutually exclusive: workers may experience improvements in safety or physical working conditions while simultaneously becoming uncertain about future employment, occupational status, or their ability to meet new technical requirements.

The empirical literature consequently demonstrates that automation in the food sector has interconnected technological, organizational, labor-related, and policy dimensions. However, studies have tended to examine these dimensions separately or focus predominantly on expected efficiency and competitiveness gains. Limited attention has been paid to how policy expectations, company strategies, and workers' experiences interact within the same sectoral setting. By examining government policy documents together with managerial, blue-collar, and white-collar perspectives, this dissertation investigates how automation is anticipated, implemented, and experienced across different levels of Turkey's food industry.

2.3 Summary of Literature Review

The literature reviewed in this chapter indicates that Industry 4.0-related technologies may transform production systems, workforce structures, and organizational practices. While automation, digitalization, and artificial intelligence may improve productivity, workplace safety, and competitiveness, they may also contribute to changing skill requirements, work

intensification, job insecurity, and unequal access to technological opportunities. These consequences are neither uniform nor technologically predetermined but depend on institutional arrangements, organizational strategies, labor-market conditions, task composition, and workers' access to training. Debates concerning skill- and routine-biased technological change help explain how these effects may differ according to the susceptibility of tasks to technological substitution or complementarity, although recent developments in artificial intelligence have made these distinctions increasingly complex.

The Sociology of Expectations provides the primary theoretical framework of this dissertation. It approaches technological futures not merely as predictions but as socially constructed expectations that can influence decisions and actions in the present. Policy narratives concerning national competitiveness and modernization, corporate expectations of productivity and efficiency, and workers' expectations regarding employment security, skills, and occupational change may support, challenge, or reshape one another. This framework therefore enables the dissertation to examine when expectations align, when they conflict, and how their meanings are translated between policy, organizational, and workplace levels.

The empirical literature demonstrates that the adoption and labor-market effects of automation vary across national, sectoral, and organizational contexts. Evidence from highly industrialized economies cannot be transferred directly to developing countries, where industrial capacity, labor costs, educational systems, technological infrastructure, and social protection arrangements may differ considerably. Developing economies such as Turkey consequently face a tension between maintaining competitiveness through relatively labor-intensive production and pursuing competitiveness through technological upgrading.

This tension is particularly relevant to Turkey's food industry, which occupies an important position in the national economy and combines labor-intensive production with uneven technological adoption. Reports by TÜSİAD and the Turkish Ministry of Family, Labor and Social Services indicate that digital transformation and workforce adaptation have become important policy and industrial concerns. Nevertheless, differences in firms' financial resources, technological capacity, access to qualified personnel, and ability to provide training mean that automation may affect companies, occupational groups, and workers unevenly.

Although research on automation and Industry 4.0 is expanding, it frequently concentrates on technological adoption, productivity, competitiveness, or projected macroeconomic and employment outcomes. Within the literature reviewed for this dissertation, workers'

experiences appear comparatively underexamined, particularly in labor-intensive sectors and developing-country contexts. Moreover, policy discourses, organizational strategies, and workers' interpretations are often investigated separately. Consequently, less is known about how national expectations of technological modernization are translated into company strategies and workplace practices, or how workers in different occupational positions interpret and respond to these changes.

This dissertation addresses this gap by examining policy documents together with the perspectives of managers, blue-collar workers, and white-collar workers in Turkey's food industry. By connecting policy narratives, organizational strategies, and workplace experiences, it investigates how expectations concerning automation are constructed, translated, negotiated, and experienced across different levels. It also considers how these expectations vary according to institutional position, organizational context, task composition, access to training, and previous experiences of technological change.

The next chapter outlines the methodological approach used to investigate these relationships and explains the research design, data collection process, and analytical framework adopted in the study.

3. Data and Methods

3.1 Research Approach and Design

This dissertation examines how workers and managers experience and interpret the new automation technologies associated with Industry 4.0 and how these technologies relate to the organization of work in the selected food-production workplaces. To achieve this, the study employed qualitative research methods and adopted an exploratory case-study design. An exploratory design was chosen to investigate ongoing developments related to new technologies and labor, while the case-study approach enabled these developments to be examined within their real-world organizational contexts (Yin, 2018). More specifically, the study was conducted across two organizational sites belonging to the same business group. The analysis focused on participants' accounts of current workplace conditions as well as their expectations concerning near-future technological and occupational change.

The research combined primary data from semi-structured, in-depth interviews with contextual material from selected policy and sectoral documents. Interviews were conducted with blue-collar workers, white-collar employees, and managers to examine how technological transformation was experienced and interpreted from different occupational positions. Participants' educational backgrounds, gender, and age were considered when examining variation within the participant group, but these characteristics were not used to establish statistically generalizable demographic differences.

The policy and sectoral documents were used to situate participants' accounts within broader institutional and sectoral narratives concerning industrial digitalization, workforce development, and technological adaptation. The interview and documentary materials were analyzed thematically. Accounts from different occupational groups were compared, as were the workplace experiences described in the interviews and the expectations presented in the policy documents. The primary analytical comparison was conducted across blue-collar workers, white-collar employees, and managers rather than between the two organizational sites.

Bringing these sources together made it possible to examine how technological change was experienced and understood in the selected workplaces and how participants expected it to affect work in the future. It does not aim to provide statistical generalization to Turkey's food industry as a whole, and the selected documents are not treated as direct evidence of policy implementation across the sector.

3.2 Data Sources and Method of Data Collection

This dissertation draws on two main sources of data: semi-structured interviews and selected policy and sectoral documents. Academic research was used to develop the theoretical and contextual foundations of the study, while selected official documents and reports formed the secondary empirical material. The relevance of these documents to the research questions and the procedures used for their selection and analysis are explained in Section 3.2.1.

The primary data were collected through semi-structured interviews with blue-collar workers, white-collar employees, and managers from two food-production companies in Turkey belonging to the same business group. One company operates on a large scale, while the other represents a medium-to-large-scale production environment. The companies were selected because research access could be obtained and both provided opportunities to examine how automation-related technologies were being introduced and used in food production. The presence and reported use of automation-related technologies, including conveyor systems, digital production-monitoring applications, ERP-based planning tools, data-supported quality-control mechanisms, and newer production machinery, made it possible to examine how technological transformation was experienced and interpreted by different organizational actors within comparable but not identical production settings.

The interviews provided accounts of how workers and managers experienced and interpreted technological and organizational change, while the documentary materials were used to examine how technological and workforce transformation was framed in selected policy and sectoral narratives. The documents were not treated as representing the perspective of government as a unified actor or as direct evidence of policy implementation across the food industry.

Access to the two organizational sites was facilitated through an existing contact within the management of the business group. Initial contact with the production management was followed by the communication of the research purpose, interview topics, and proposed questions to the relevant human-resources representatives. Management and human-resources representatives identified potential participants primarily according to their availability during the data-collection period, while also considering the researcher's request to include blue-collar workers, white-collar employees, and managers and to seek gender balance within the worker groups.

Participation was voluntary and separate from participants' employment responsibilities. Potential participants were informed by both the researcher and the managers facilitating access that the interviews formed part of an independent university-based PhD research project, and that their decision to participate or decline would not affect their employment. Before conducting each semi-structured interview, the researcher communicated directly with the participant, introduced herself, explained the purpose of the study, and reiterated the voluntary nature of participation. Interviews proceeded only after participants agreed to take part.

Interview data collection took place between July 2022 and September 2023. Twenty-five participants were interviewed: ten blue-collar workers, ten white-collar employees, and five managers. Interviews lasted approximately 35–50 minutes. The documentary corpus was compiled and subsequently updated to include the selected policy documents published in 2024. Documentary analysis was therefore conducted separately from the interview-data-collection period. The demographic and occupational characteristics of the participants are presented in Table 4.

Table 4. Demographic and Occupational Characteristics of Participants

	WORKER TYPE	AGE	GENDER	EDUCATION
1.	Blue-Collar Worker	45	Female	Primary School Education
2.	Blue-Collar Worker	49	Female	Primary School Education
3.	Blue-Collar Worker	35	Female	High School Diploma
4.	Blue-Collar Worker	38	Female	High School Diploma
5.	Blue-Collar Worker	47	Male	Primary School Education
6.	Blue-Collar Worker	34	Male	High School Diploma
7.	Blue-Collar Worker	42	Male	Primary School Education
8.	Blue-Collar Worker	36	Male	High School Diploma
9.	Blue-Collar Worker	44	Female	Primary School Education
10.	Blue-Collar Worker	37	Male	Primary School Education
1.	White-Collar Worker	29	Female	BA in Social Sciences
2.	White-Collar Worker	32	Male	BA in Social Sciences
3.	White-Collar Worker	34	Female	BA in Social Sciences
4.	White-Collar Worker	36	Male	MSc in Food Engineering
5.	White-Collar Worker	35	Male	BSc in Food Engineering
6.	White-Collar Worker	36	Female	MSc in Chemistry/Chemical Sciences
7.	White-Collar Worker	28	Male	BSc in Industrial Engineering
8.	White-Collar Worker	31	Male	BSc in Food Engineering
9.	White-Collar Worker	36	Female	MSc in Food Engineering
10.	White-Collar Worker	32	Female	BSc in Industrial Engineering
1.	Factory Manager	37	Male	PhD in Food Engineering
2.	Operations Manager	36	Female	MSc in Food Engineering
3.	R&D Manager	41	Female	MA in Industrial Engineering
4.	Production Manager	44	Male	MSc in Food Engineering
5.	HR Manager	38	Male	BA in Social Sciences

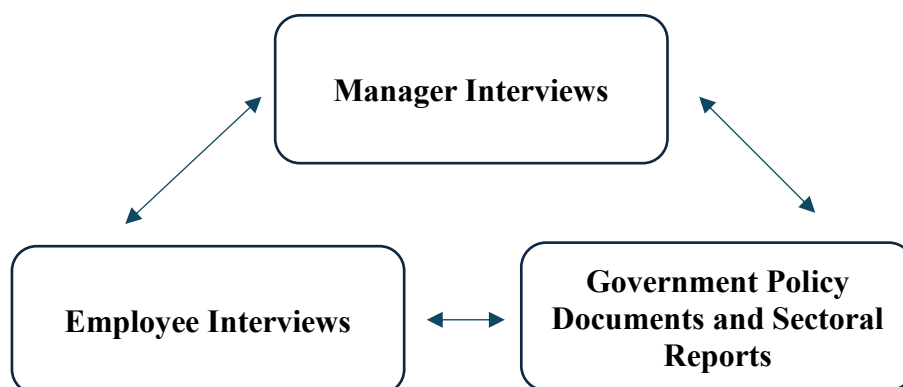
Demographic characteristics were used to examine variation within the qualitative sample; the observed patterns should therefore be treated as exploratory rather than as statistically generalizable differences.

The sampling strategy combined purposive criteria with gatekeeper-mediated, availability-based recruitment. Purposive criteria were used to obtain variation in occupational position, gender, educational background, age, and job role. Particular attention was given to maintaining gender balance within the blue-collar and white-collar participant groups and to including equal numbers from these two workforce categories. However, the final participant pool was also shaped by the individuals made available through management and HR and by employees' willingness to participate.

Age diversity was sought where possible, although the final distribution was shaped by employee availability and willingness to participate and was uneven across occupational groups. Age-related comparisons were therefore exploratory and interpreted cautiously, as differences associated with age could not always be separated from occupational position, educational background, technological familiarity, or workplace responsibility. The sampling strategy was intended to obtain varied and detailed accounts of how workers and managers within the selected settings experienced and anticipated automation and Industry 4.0 technologies.

The study compared interviews, policy documents, and sectoral reports to examine how technological transformation was experienced and described across different sources. The documents were not used to confirm whether participants' statements were correct. Instead, the comparison showed where workplace accounts and broader institutional narratives corresponded, differed, or addressed different issues. Figure 4 summarizes these data sources.

Figure 4. Triangulation of Primary and Secondary Data Sources



Source: Author's own elaboration, 2022.

3.2.1 Policy and Sectoral Documents

Academic studies and documentary materials served different purposes in this research. Academic literature provided the theoretical, technological, and sectoral background. Selected policy documents and sectoral reports were analyzed as research material to examine how institutions and industry-oriented sources described Industry 4.0, technological transformation, and their expected consequences for the workforce.

The analysis of state policies focused primarily on official reports and strategy documents published by the Ministry of Labor and Social Security, the Ministry of Industry and Technology, and relevant labor-market and vocational-qualification institutions, including İŞKUR and the Vocational Qualifications Authority (MYK). These institutions were selected because their areas of responsibility included labor and employment policies, industrial development, technological investment, skills, vocational training, and workforce adaptation. Reports, strategy documents, and long-term plans made publicly available through official institutional websites were examined to identify stated priorities concerning technological transformation and its relationship with labor. The analysis focused on how these issues were represented in the documents rather than assuming that the stated policies had been implemented in practice.

The documents were selected according to their relevance to the research questions. To be included in the documentary corpus, a source had to address at least one of the following areas: Industry 4.0 or industrial digitalization, technological investment and innovation, employment and workforce transformation, skills and vocational training, or institutional support for technological adaptation. The core policy corpus consisted of 10 documents published between 2022 and 2024 and obtained from official institutional websites. The complete list, including the issuing institution, policy-document title, and main thematic area of each document, is presented in Appendix 6.3, Table 10.

Within this framework, the documents were examined to assess how technological transformation, labor policies, and Industry 4.0 integration were connected in selected policy narratives. Particular attention was given to the objectives and challenges identified in relation to competitiveness, employment, skills, training, technological investment, and workforce adaptation. The analysis also examined who was expected to take responsibility for adaptation, including employers, workers, educational institutions, and public bodies. Drawing on the

Sociology of Expectations, it considered how visions of the technological future were used to support current priorities concerning investment, competitiveness, training, and institutional support.

The report published by TÜSİAD (2016) provided a sector-level assessment produced by a major business association in Turkey. The selected reports addressed the potential contribution of Industry 4.0 technologies to productivity and competitiveness while also discussing challenges such as skill shortages, implementation costs, organizational readiness, and infrastructural limitations. These reports were used to examine how technological transformation and corporate preparedness were framed from a business-oriented perspective. However, they were not treated as representing the strategies or experiences of all companies operating in Turkey's food industry.

In addition, sector-specific and technical studies on automation, IoT applications, blockchain technologies, and data analytics provided contextual information about the possible use of these technologies in food-production processes. Sources addressing sustainability and ethical concerns also supported the interpretation of the broader social implications associated with Industry 4.0. These materials helped contextualize the technologies and implementation challenges discussed in the policy documents and interviews. However, they were not used to determine the level of technological adoption across Turkey's food industry, and information from the selected companies was not treated as representative evidence of sector-wide implementation.

The documentary analysis followed a thematic procedure. The selected documents were read and examined for recurring references to technological transformation, employment, skills, training, competitiveness, investment, infrastructure, workforce adaptation, and the anticipated social and economic consequences of Industry 4.0. Relevant passages were organized according to these analytical areas. The analysis also considered differences, tensions, and silences across the documents, including possible tensions between objectives concerning technological competitiveness and those concerning employment protection and workforce development.

The policy and sectoral materials were subsequently compared with the interview findings to identify areas of convergence and divergence between institutional narratives and workplace accounts. This comparison was not intended to use the documents to verify the statements of workers and managers. Instead, it examined how technological transformation was framed at

different analytical levels and whether policy narratives concerning competitiveness, skills, reskilling, and adaptation corresponded with or differed from participants' experiences and expectations.

This analysis helped place the workplace experiences described in the interviews within a broader policy and sectoral context. The documents showed how institutions and industry-oriented sources framed technological transformation; they were not treated as evidence that policies had been implemented or that the same conditions existed throughout Turkey's food industry. The findings from this analysis are therefore limited to the selected document corpus and do not constitute an evaluation of all Turkish policies, business strategies, or Industry 4.0 practices in the sector.

3.2.2 Primary Data (Interviews with Workers and Managers)

The primary data were collected through semi-structured, in-depth interviews with workers and managers in Turkey's food-production sector. The interviews aimed to examine participants' experiences and interpretations of Industry 4.0 technologies, including their perceived effects on production processes, work organization, workforce adaptation, and organizational strategies.

The interviews explored participants' experiences of technological transformation, perceptions of automation, workplace adaptation processes, future employment expectations, and views regarding organizational and policy responses to Industry 4.0. Blue-collar workers were primarily asked about changes in daily tasks, working conditions, training, workplace relations, and job security. White-collar employees discussed changing responsibilities, skill requirements, professional authority, and career expectations. Managers provided accounts of technological investment, implementation conditions, organizational readiness, workforce planning, and the perceived role of institutional support. These areas provided a common basis for comparison while allowing attention to the different organizational positions of the participants.

The interview guides were developed based on the research questions, the literature on Industry 4.0 and labor, and the Sociology of Expectations framework. A common thematic structure was maintained across the participant groups, while certain questions were adapted to reflect the organizational positions and experiences of blue-collar workers, white-collar employees, and managers. In addition to participants' current experiences, the questions examined their expectations, concerns, and interpretations of possible future changes in employment, skills,

and production. This made it possible to examine how participants connected anticipated technological futures with their present interpretations of and responses to automation. The interview guides used for the three participant groups are provided in Appendix 6.1.

All interviews were conducted by the researcher in Turkish, the native language of the participants. Depending on participants' availability and workplace conditions, interviews were conducted either face-to-face or by telephone. Before the interviews, participants were informed about the purpose of the research and the confidentiality of their responses. The semi-structured format allowed the researcher to follow the main themes of the interview guide while also asking follow-up questions when participants raised relevant experiences or concerns.

The interviews were analyzed in Turkish. Participant quotations selected for inclusion in the dissertation were translated into English by the researcher during the reporting stage. The translations aimed to preserve participants' intended meanings and occupational terminology rather than reproduce Turkish syntax literally. The translated extracts were checked against the original Turkish transcripts before finalization.

With participants' consent, most interviews were audio-recorded and subsequently transcribed by the researcher. Detailed notes were also taken during or immediately after the interviews. In a small number of cases in which audio recording was not possible or was not preferred by the participant, detailed notes were taken during the interview and expanded immediately afterwards. These notes were included in the analysis but were interpreted with recognition that they did not provide the same level of detail as full audio recordings and transcripts. This procedure respected participants' preferences while allowing their accounts to be included in the study.

Participant selection considered occupational position, gender, age, educational background, and job role to obtain varied accounts of technological transformation within the selected workplaces. These characteristics were used to support comparisons across participants rather than to establish statistically representative demographic patterns. Age- and gender-related differences were therefore examined cautiously and in relation to other factors, including occupational position, education, technological familiarity, workplace responsibility, and access to training. The interviews also supported comparison between managerial assessments of technological implementation and workers' accounts of its implications for everyday work.

The interviews provided participant accounts of how workers and managers within the selected organizational settings interpreted and responded to technological change. The interviews

showed what participants considered beneficial or difficult about automation and how their current workplace experiences shaped what they expected for their future jobs, skills, and organizations. These accounts were treated as situated interpretations shaped by participants' organizational positions and experiences rather than as representative of all workers, managers, or food-production companies in Turkey.

The interview process also involved limitations related to the sensitivity of workplace-based research. Some participants appeared cautious when discussing their companies' practices, management decisions, or employment concerns. The researcher addressed this by emphasizing confidentiality and creating space for participants to describe their experiences in their own terms. Nevertheless, the possibility of restrained or socially desirable responses could not be eliminated. This limitation was considered during the analysis, particularly when interpreting the absence of criticism or comparing workers' and managers' accounts.

3.3 Ethical Considerations

Before their involvement, all participants were informed about the purpose, scope, and methodology of the research. Since the study addressed new technologies, Industry 4.0, government policies, and company strategies, preliminary explanations were adapted to the participants' occupational backgrounds and presented in clear and accessible language. This information was explained verbally before the interviews. Participants were informed that their involvement was entirely voluntary and that they could withdraw at any time without providing a reason.

Particular attention was paid to confidentiality and the protection of participants' identities. Participants were informed that their names and personal details would not be disclosed in the dissertation or related publications. Participant codes were used in the research records and reporting, and directly identifying information was removed from the material included in the analysis. Interview recordings and transcripts were stored on encrypted devices, with access restricted to the researcher. The data were used solely for academic purposes.

Because the interviews addressed potentially sensitive subjects, including job insecurity, workplace relationships, company strategies, and concerns about technological change, efforts were made to create a respectful and non-judgmental interview environment. Each interview began with general questions about participants' work experiences and perspectives before moving gradually towards more personal or sensitive topics. Questions were framed neutrally, and participants were not pressured to discuss matters they preferred not to address. When

participants moved beyond the central interview topics to discuss economic, political, or personally significant issues, their views were heard respectfully before the conversation was gently directed back to the research questions when necessary.

As the interviews were conducted with employees in organizational settings, particular attention was also paid to potential power imbalances and concerns about workplace repercussions. Participants were informed that the content of their interviews, individual statements, recordings, and transcripts would not be disclosed to company management. The findings were reported without attributing individual statements to identifiable employees. This separation was intended to reduce concerns about employer access and provide participants with space to describe their experiences in their own terms.

These measures were maintained throughout data collection, analysis, and reporting to protect participants' privacy, autonomy, and occupational position. Nevertheless, confidentiality assurances could not entirely eliminate the possibility that some participants remained cautious when discussing their employers, management practices, or job security. This possibility was considered when interpreting the interview material, particularly the absence of criticism or the use of restrained responses.

3.4 Method of Data Analysis

This research adopted thematic analysis as its primary method of qualitative data analysis. Thematic analysis, as described by Braun and Clarke (2006, 2019), provides a structured yet flexible framework for identifying, analyzing, and interpreting patterns within qualitative data. This method was suitable for examining how workers and managers in the selected workplaces experienced and interpreted Industry 4.0, automation, and their implications for work and employment.

Consistent with a reflexive approach to thematic analysis, themes were understood as interpretive constructions developed through the researcher's engagement with the data rather than as objective categories simply discovered within the material. The researcher's familiarity with the Industry 4.0 literature, the Sociology of Expectations framework, and the research questions informed the interpretation of participants' accounts. This theoretical sensitivity was acknowledged throughout the coding and theme-development process.

The interview analysis was primarily inductive, with codes and themes developed from participants' accounts. However, it was also informed by the research questions and the Sociology of Expectations framework, particularly when examining how participants

connected present experiences of technological change with anticipated developments in employment, skills, and production. The analysis should therefore be understood as data-driven but theoretically informed rather than as entirely independent of prior concepts.

The process began with familiarization with the data. Audio-recorded interviews were transcribed verbatim, while detailed notes from non-recorded interviews were expanded immediately after each interview. The transcripts and interview notes were then read repeatedly to identify initial patterns and establish connections between participants' organizational positions, experiences, and expectations. The researcher conducted the coding manually and examined the material systematically to identify recurring concepts, concerns, and experiences.

Initial codes included participants' perceptions of automation, changes in work tasks, workplace adaptation, training, skill development, job security, managerial strategies, policy support, and future expectations. Related codes were subsequently grouped into broader categories and reviewed iteratively across the dataset. For example, references to fear of job loss, uncertainty about future employment, and concerns about technological replacement were initially coded separately and later considered under the broader theme of job security and future employment expectations. The coding structure was refined as relationships and distinctions emerged within and across participant accounts.

The categories were then developed into broader themes and sub-themes based on their conceptual relationships and relevance to the research questions. These included workforce adaptation to new technologies, changing tasks and skill requirements, job security and future expectations, managerial approaches to technological implementation, and perceptions of organizational and policy support. Themes were reviewed in relation to the coded extracts and the wider dataset to assess their internal coherence and distinguish them from one another. They were then defined and named to capture their central analytical focus.

The final stage involved integrating the themes with illustrative participant accounts and relating them to the research questions, the Sociology of Expectations framework, and the relevant literature in the presentation of the findings.

In addition to thematic coding, participants' accounts were compared across occupational position, gender, and age. Occupational comparisons included blue-collar workers, white-collar employees, and managers, while demographic comparisons among workers considered gender and the age groups of 18–40 and over 40 years. These dimensions were used to identify similarities and differences within the selected sample rather than to establish general

demographic patterns. Age and gender were not treated as independent or fixed explanations; their possible relevance was considered alongside education, job role, technological familiarity, workplace responsibility, and access to training. Earlier studies have shown that age and gender may moderate employees' perceptions, adoption, and continued use of new workplace technologies (Morris et al., 2005; Venkatesh et al., 2003). Nevertheless, the interpretation remained grounded in the accounts of the participants in this study.

The policy documents and sectoral reports described in Section 3.2.1 were also examined thematically. The documentary analysis focused on recurring references to technological transformation, employment, skills, training, competitiveness, investment, infrastructure, and workforce adaptation. Particular attention was paid to how anticipated technological futures were connected to present policy objectives and proposed actions. The documentary findings were then compared with the interview findings to identify areas of convergence, divergence, and institutional silence between policy narratives, managerial assessments, and workers' experiences.

To support the rigor and interpretive credibility of the analysis, codes and themes were reviewed repeatedly against the original interview material, and differences within participant groups were retained rather than removed in pursuit of uniform findings. Comparison across interviews, policy documents, and sectoral reports was used to examine how technological transformation was understood at different analytical levels. This process was not intended to treat one source as verification of another but to identify where workplace experiences, managerial perspectives, and institutional narratives corresponded or differed.

The findings were interpreted within the boundaries of the selected companies, participants, and documents. The study does not claim to represent Turkey's entire food industry. Instead, it explains how technological transformation was experienced, understood, and anticipated within the workplaces examined.

3.5 Limitations

Organizational access and participant recruitment were facilitated by management and human-resources representatives, who identified potential participants primarily according to their availability while also considering the researcher's request for gender balance. Although participation was voluntary and the researcher communicated directly with participants before the interviews, this recruitment procedure may have influenced the composition of the sample. Employees who were less available, less visible to management, or potentially more critical of

organizational practices may therefore have been underrepresented. The findings should consequently be interpreted as accounts provided by the participants included in the study rather than as representing the full range of employee perspectives within the two companies.

4. Results and Discussion

This chapter is organized into four main sections. Section 4.1 examines the position of labor in relation to new automation systems and Industry 4.0, focusing on changing job roles, skill requirements, working conditions, and the social implications of technological transformation. Section 4.2 presents the empirical findings from the interviews. It first examines the perspectives of blue-collar workers, white-collar employees, and managers separately and then provides a comparative thematic analysis of job security, adaptation, training and skill development, workplace hierarchy, emotional responses, and future expectations across the three participant groups. Section 4.3 examines how policy-level imaginaries were translated, aligned, and contested within organizational and workplace settings. Section 4.4 then synthesizes the broader sociological implications of the findings for the organization, quality, and anticipated future of work.

The integration of Industry 4.0 technologies into food production has been identified in the literature as a catalyst for increased productivity, resource optimization, and operational efficiency (Schwab, 2016). These advancements are increasingly utilized to enhance real-time monitoring, improve process efficiency, and optimize supply chain operations, particularly in industrialized food production (TÜSİAD, 2016). However, while automation promises efficiency and cost-effectiveness, it also brings significant uncertainties and challenges, particularly concerning workforce dynamics, job security, and skill requirements. Studies indicate that automation-driven transformations contribute to labor market polarization, disproportionately benefiting high-skilled workers while displacing lower-skilled employees, thereby exacerbating economic inequality (Autor, 2015). This trend is particularly evident in Turkey's food sector, where technological adoption remains uneven across different workforce segments, and smaller firms struggle with financial and structural barriers (Yüksekbilgili & Çevik, 2018).

To explore these issues, this chapter addresses three central questions: How do blue-collar and white-collar workers perceive the effects of Industry 4.0 technologies on their current work experiences and future employment prospects? What implications do these technologies have for labor dynamics and workforce structures in the workplaces examined, and how do managers approach technological implementation and workforce adaptation? How are national policy expectations interpreted within managerial accounts, and what patterns of alignment and tension emerge when these expectations are compared with workplace experiences? These

questions guide the analysis of how automation is experienced, organizationally managed, and interpreted across workplace and policy levels.

4.1 The Position of Labor in the Context of New Automation Systems and Industry 4.0

As Industry 4.0 technologies enter production, they raise questions about how workers' roles change and how people work alongside automated systems, both globally and in developing countries. In this context, Turkey is undergoing a process of restructuring associated with technological transformation, while workforce roles and skill requirements are also changing. These developments suggest that labor is being repositioned within parts of the food industry. This section examines how technological transformation may redefine labor roles, alter workforce structures, affect employment security and working conditions, and create new skill requirements. Understanding how labor adapts to conditions shaped by new technologies provides an important foundation for the empirical analysis presented in the following sections.

The adoption of new automation systems has created uncertainty about employment security, particularly in occupations involving repetitive and manual tasks. According to Çelik et al. (2018), these occupations are potentially more exposed to automation-related displacement. However, the effects of automation cannot be understood only through the possibility of job loss. Technological transformation may also reorganize existing tasks, redistribute responsibilities between workers and machines, and change the forms of knowledge valued within production. Blue-collar and white-collar employees may experience these developments differently because their positions, educational backgrounds, technical responsibilities, and access to technological resources are not the same. Automation may therefore create new opportunities for some workers while increasing uncertainty for others whose existing skills are less closely aligned with emerging production systems.

Another significant dimension of automation is the growing need for reskilling and upskilling. Workers' existing knowledge may not always be sufficient to meet the requirements of new technologies and automation systems, which increases the importance of education and training programs. Petekçi (2021) points out that workers may need to acquire competencies in areas such as data analysis, system administration, and digital literacy to remain professionally relevant in a changing labor market. Similarly, as operational tasks move towards supervisory and analytical responsibilities, the implementation of Industry 4.0 in food processing requires substantial workforce development (Akyazi et al., 2020; Romanello & Veglio, 2022).

Nevertheless, access to these opportunities may vary according to educational background, socioeconomic position, geography, occupational role, and previous technological experience. Training can therefore support professional development while also reproducing existing differences when workers do not have equal access to understandable, practically relevant, and continuing learning opportunities.

Automation may also create tensions between efficiency objectives and workers' social and emotional experiences. As Berktaş and Dimli Oraklıbel (2021) point out, Marx's theory of alienation provides a framework for examining how technological progress may distance workers from the meaning and outcomes of their labor by reducing their roles to interactions with machines. Technologies that reduce physical strain and improve production efficiency may simultaneously change workers' control over the rhythm and organization of their tasks. Machine-determined production processes can also affect autonomy, professional identity, workplace interaction, and the value attached to experience-based knowledge. Hesitation towards automation should therefore not automatically be interpreted as resistance to technological progress. Workers' responses may also reflect uncertainty about the reliability and necessity of new systems, changing responsibilities, and their future position within production.

The relationship between labor and automation is also shaped by company strategies and relevant state policies. The organization of education and training programs, the assessment of emerging skill needs, and the development of workforce-support mechanisms are important for facilitating technological transition. According to Ötleş and Özyurt (2016), aligning educational frameworks with Industry 4.0 requirements is necessary for preparing employees for changing technological demands. At the company level, transparent communication, gradual implementation, participatory decision-making, and access to continued training may help balance technological efficiency with workforce well-being. At the policy level, support for technological investment needs to be considered together with workforce development and the unequal capacities of workers and companies to participate in digital transformation.

Overall, the changing position of labor in the context of Industry 4.0 involves interconnected opportunities, uncertainties, and challenges. New technologies may contribute to efficiency, productivity, and improvements in particular working conditions, while also raising questions about employment security, skill development, autonomy, workplace inclusion, and social equality. Addressing these issues requires coordinated strategies involving workers,

companies, educational institutions, and policymakers. The following sections examine how these broader transformations were experienced and interpreted by the blue-collar workers, white-collar employees, and managers interviewed in this study.

4.2 Perspectives on New Technologies from Different Workforce Segments

4.2.1 Perspectives from Blue-Collar Workers

This section analyses the responses obtained through semi-structured interviews with ten blue-collar workers, comprising five women and five men. An overview of the participants is presented in Table 5.

Table 5. Demographic Profile of Blue-Collar Participants

	WORKER TYPE	AGE	GENDER	EDUCATION
1.	Blue-Collar Worker	45	Female	Primary School Education
2.	Blue-Collar Worker	49	Female	Primary School Education
3.	Blue-Collar Worker	35	Female	High School Diploma
4.	Blue-Collar Worker	38	Female	High School Diploma
5.	Blue-Collar Worker	47	Male	Primary School Education
6.	Blue-Collar Worker	34	Male	High School Diploma
7.	Blue-Collar Worker	42	Male	Primary School Education
8.	Blue-Collar Worker	36	Male	High School Diploma
9.	Blue-Collar Worker	44	Female	Primary School Education
10.	Blue-Collar Worker	37	Male	Primary School Education

The interviews were conducted face-to-face or by telephone after participants were informed about the study and reassured that their responses would remain confidential and would not affect their employment.

The interviews revealed different experiences of automation in relation to task allocation, working conditions, training, job security, and career development. Within this sample, participants' accounts varied according to their age, educational background, technological familiarity, and workplace responsibilities. The findings are presented thematically below.

4.2.1.1 Job Responsibilities and Automation's Impact on Tasks

The interviews indicated differences in task allocation according to workers' educational backgrounds, technical familiarity, and positions in production. Within the blue-collar sample, several participants with elementary-school education performed repetitive manual activities, including sorting, packaging, and production-line work, while some participants with high-school education were involved in machine operation, monitoring, or quality control. However, education did not correspond uniformly with workplace responsibilities. Worker 10, for

example, worked as a maintenance technician despite having elementary-school education, while Worker 8 was responsible for monitoring automated systems and production processes. These differences point to a distinction within the sample between workers performing predominantly manual tasks and those more directly engaged with automated systems. Participants involved in technical or machine-related responsibilities generally expressed greater confidence about their continuing position and possible career opportunities. By contrast, some workers with less formal education expressed concerns about keeping pace with technological change. Automation was therefore described both as an opportunity for developing new skills and as a source of uncertainty, depending partly on participants' existing responsibilities and familiarity with automated systems.

The findings suggest that technological familiarity was becoming an additional factor in how participants understood task allocation and opportunities for advancement. However, the examples of Workers 8 and 10 also show that formal education alone did not determine access to technical responsibilities. Within the workplaces represented in this study, the changing value of skills appeared to be shaped by the interaction between education, practical experience, technological familiarity, and employees' positions in production.

4.2.1.2 Experiences with Automation: Advantages and Challenges

Blue-collar participants described automation as bringing practical benefits while also disrupting established work practices. Their accounts combined improvements in production efficiency, quality, and physical working conditions with difficulties related to adaptation and changing workplace routines.

Several participants associated automation with faster production, reduced physical strain, and the simplification of repetitive tasks. Conveyor belts, computerized control systems, and automated packaging and labelling equipment were described as enabling particular processes to be completed more quickly and with less physical effort. Worker 5 described the effect of an automated sorting system: *'Before, we had to manually sort many things on the production line, which was more difficult and time-consuming. Now, with the new machine, the process is much faster and less physically demanding.'*

Participants involved in production monitoring and quality control also emphasized improvements in accuracy and consistency. In their accounts, automated monitoring systems allowed defects to be identified more quickly and production lines to be adjusted in real time. As Worker 6 explained, *'The automated quality-control system helps us detect and remove*

defective products much faster than before, ensuring that everything meets the required standards and improving overall production quality.'

These perceived benefits were accompanied by difficulties in adjusting to new machinery and restructured production processes. Some participants described changes to familiar routines as stressful or demanding, particularly when they were required to acquire unfamiliar skills. Within this sample, participants with longer experience in established production routines more frequently emphasized the difficulty of this adjustment.

Collectively, participants did not describe automation as either wholly beneficial or wholly disruptive. They recognized its contribution to efficiency, quality, and reduced physical strain while also emphasizing the demands created by changing routines and skill requirements. Their accounts therefore present automation as a workplace transition whose perceived effects depended not only on the technologies introduced but also on participants' existing responsibilities, previous experience, and the manner in which new systems were implemented.

4.2.1.3 Training and Adaptation to Automation

Blue-collar participants' experiences of adapting to automation varied according to their educational backgrounds, technological familiarity, established work routines, and access to workplace support. Participants with greater familiarity with technical systems generally expressed more confidence in learning to use automated machinery. By contrast, computerized control systems and automated diagnostics were described as more challenging by participants with limited previous experience of digital technologies.

Some participants with longer experience in established production routines acknowledged the practical benefits of automation while also describing continuous learning as an additional demand. Worker 7 explained: *'Automation has definitely improved speed and accuracy, but it also means we have to learn new skills when new machines come. For some of us who have been here for years, adapting to these changes is not always easy, but we get used to it after some time.'* His account illustrates the ambivalent character of adaptation: technological change could make particular tasks easier while requiring workers to revise skills and routines developed through years of experience.

Participants described different forms of preparation for automation, including formal company training, instruction related to particular machines, learning through observation, and direct practice on the production line. Formal sessions were generally facilitated by engineers, production managers, or other white-collar employees, who explained the purpose of new

technologies, demonstrated machinery operations, and introduced changes to existing workflows. Some participants also relied on assistance from colleagues, particularly when structured instruction was limited or when difficulties emerged during daily production.

Training was not experienced uniformly within the sample. Some participants with high-school education or greater technological familiarity regarded it as an opportunity for professional development and occasionally assisted colleagues in learning new systems. Other participants described training as complicated or disruptive to familiar routines. Worker 2 expressed a perceived age-related difference in technological familiarity: *'I am somehow working in the given job, young people have a lot to do with technology.'* Although this statement does not represent a rejection of automation, it reflects uncertainty about her own position in relation to technological change and about whether all workers could benefit equally from automation-related learning.

Participants' accounts also connected training with career progression and employment security. Some regarded automation-related learning as a means of developing their skills and gaining access to more technically valued responsibilities. For others, continuous upskilling was experienced less as a voluntary opportunity than as a requirement for remaining employable. Worker 7 captured this pressure: *'Machines make things easier, but training is complicated. Machines are smarter than us; it can be difficult until we figure it out.'* This account demonstrates that learning was not necessarily experienced as an intrinsically positive aspect of work. For some participants, it represented a form of compelled adaptation shaped by concerns about keeping pace with technological change.

Workplace communication influenced how participants interpreted and engaged with training. Those who received clear explanations about the purpose of new technologies, expected workflow changes, and their future responsibilities described feeling more prepared for the transition. Participants who received hurried instruction or limited guidance were more likely to describe confusion about their changing roles. Training was therefore described more positively when technical instruction was connected to participants' everyday responsibilities and accompanied by continuing practical support.

Training helped some blue-collar participants adapt to automation, but not everyone was able to benefit from it in the same way. Their ability to benefit from training was associated with their previous education, technological familiarity, established work experience, learning needs, and the clarity of workplace communication. The findings suggest that automation-related learning may support professional development while becoming an additional

employment pressure for workers who experience continuous adaptation as necessary for maintaining their positions.

4.2.1.4 The Impact of Automation on Workflows and Productivity

Participants' accounts indicate that automation reshaped blue-collar workflows through greater efficiency and standardization while also introducing a more rigid, machine-determined work rhythm. These changes concerned not only production speed and accuracy but also participants' perceived control over their tasks, workplace interaction, and the meaning they attributed to their work.

Several participants associated automation with faster and more standardized production processes. Automated systems reduced particular forms of manual work and enabled production problems to be identified and addressed more quickly. Worker 9 described the reduction in physical demands: *'The work on my production line was harder before the machine came in; now the machine does the physical work, and it is better.'* Worker 10 similarly explained that real-time diagnostic alerts made it easier to identify faults and maintain automated machinery. These accounts demonstrate the practical benefits participants associated with automation in their daily work.

At the same time, several participants described having less flexibility in organizing their working pace. They contrasted earlier manual processes, in which they felt able to make minor adjustments to their routines, with automated production lines requiring closer synchronization with machine operations. Workers 3, 4, and 7 reported having limited room to modify the rhythm of their tasks, while Worker 6 associated automated production with stricter adherence to schedules. Worker 7 described feeling 'hurried along' by the machine-driven workflow, and Worker 8 similarly observed that increased efficiency was accompanied by less ability to slow down or adjust the intensity of work. Within these accounts, improvements in production efficiency therefore coexisted with a perceived decline in control over the pace and organization of work.

Some participants also connected automation with changes in workplace relationships. Worker 2 described feeling less connected to colleagues as the structured workflow reduced opportunities for the direct coordination associated with earlier manual processes. Worker 9 similarly observed that machine-based responsibilities had altered team dynamics and reduced everyday communication. These experiences were not shared uniformly. Participants involved in quality control sometimes valued the ability to concentrate more closely on precision,

whereas others experienced the reduction in interpersonal coordination as isolating and associated it with weaker workplace camaraderie.

Automation was also described as affecting the value participants attached to their established skills. Worker 7 felt that although his tasks had become less physically demanding, knowledge developed through years of experience no longer appeared to carry the same value. Worker 4 similarly associated the transition from more flexible, worker-directed production to systematic monitoring with a reduction in craftsmanship and described work as becoming more passive and repetitive. As one participant summarized, *'Before, production was more manual, and we were working hard. Now, production is more efficient.'* Although this statement recognizes improved efficiency, the surrounding accounts suggest that reduced physical effort did not necessarily produce a stronger sense of professional value or engagement for all participants. Collectively, participants recognized improvements in production speed, accuracy, standardization, and physical working conditions. However, some also described more rigid work rhythms, reduced flexibility, weaker social interaction, and a diminished sense of control over their tasks. Within this sample, productivity improvements were therefore experienced in relation to their consequences for autonomy, workplace relationships, and the perceived meaning of work, rather than as an exclusively technical or economic outcome.

4.2.1.5 Concerns About Job Security and Future Prospects

None of the interviewed blue-collar workers reported automation-related job loss in the companies included in the study. Nevertheless, several participants expressed uncertainty about their longer-term employment prospects as automated systems increasingly performed tasks previously undertaken manually. Automation was therefore perceived less as an immediate threat of dismissal than as a gradual transformation whose future consequences remained difficult for participants to predict.

This uncertainty was connected to observed changes in the organization of work. Several participants noted that tasks previously requiring multiple workers had been streamlined or that particular manual activities had been reduced. Worker 7 referred to the gradual decline of some manual tasks, while Worker 6 observed that new machinery had reduced the need for manual adjustments on the production line. Although participants did not associate these changes with immediate layoffs, some interpreted them as indications that their future positions might increasingly depend on their ability to operate and adapt to automated systems.

At the same time, several participants remained cautiously optimistic about the continuing role of human labor. Workers 6 and 10 expected automation to transform production without

entirely replacing the need for human supervision, problem-solving, and flexibility. As Worker 10 stated, *'We now use more machines on the production lines, but we still need human labor to complete production and manage the machines.'* Worker 4 similarly did not expect complete automation in the immediate future, although he remained uncertain about its longer-term employment consequences. Worker 5 connected this uncertainty not only to automation but also to company strategies, government policies, and broader labor-market conditions.

For some participants, the central concern was that difficulties in meeting changing skill requirements could gradually limit access to secure or technically valued responsibilities. Participants with greater technological familiarity generally expressed more confidence about adapting to these changes, whereas those who found new systems difficult to understand described greater uncertainty about their future positions. Worker 2 explained, *'We always have the necessary training from the managers, but sometimes I do not understand very quickly. These machines are good, but they are sometimes difficult to understand.'* Her account shows that access to training did not necessarily remove insecurity, as participants differed in how confidently they could apply what they had learned.

In summary, the interviews reveal a form of job insecurity based primarily on anticipation rather than experienced displacement. Participants' concerns involved the gradual reorganization of tasks, the changing value of manual expertise, and the increasing importance of technological adaptability. Within this sample, job insecurity therefore concerned not only the possibility of future unemployment but also uncertainty about career continuity, access to valued responsibilities, and the ability to remain included in changing production processes.

4.2.1.6 The Sociology of Expectations: Blue-Collar Workers' Perspectives on Automation

Blue-collar workers' expectations regarding automation were shaped by the interaction between their present work experiences, previous encounters with technological change, and broader narratives about the future of industrial production. The Sociology of Expectations (SoE) provides a framework for examining how these future-oriented interpretations influence workers' responses to technologies in the present. Within Turkey's industrial transformation, automation has been positioned as a means of strengthening productivity and economic competitiveness, particularly in a manufacturing economy historically associated with relatively low labor costs (TÜSİAD, 2016). For the workers interviewed, however, automation was understood not only as a technical development but also in relation to their future roles, career security, and position within the workplace.

Expectations differed according to workers' technological experience and perceived capacity to adapt. Younger participants and those with technical training were generally more inclined to regard automation as a necessary development and an opportunity to strengthen their professional position. Worker 6 described adaptation as essential for career continuity, while Worker 8 connected technological knowledge with future employability: *'Machines are part of the job; they speed up the work and can make more complicated jobs easier for us. Understanding technology at this time is also part of the nature of our job.'* This account reflects a broader narrative in which technological adaptation is presented as a condition for remaining professionally relevant.

Other workers approached the future more cautiously. Participants with longer employment histories interpreted previous technological changes as having reduced the importance of certain manual roles, even though they had not experienced immediate displacement. Worker 5 observed that automation had gradually eliminated some manual activities and questioned how further technological development might affect employment security. Worker 7 similarly expected human labor to remain necessary but remained uncertain about how his own responsibilities might change. These accounts demonstrate how expectations are informed by interpretations of earlier workplace transformations and can generate insecurity even under conditions of current employment stability (Selin, 2008).

Education and access to training also influenced how workers positioned themselves in relation to the future. Workers 6 and 10, who had received instruction related to automated systems, expressed greater confidence in their ability to adapt. By contrast, participants with less formal education were more likely to question whether they would receive or benefit equally from opportunities to develop new skills. Worker 1, for example, perceived younger employees as being more frequently prioritized for automation-related training. These differences suggest that expectations about technological change are shaped not only by the presence of new machinery but also by workers' perceived access to the resources needed to remain included in changing production systems (Konrad & Alvial Palavicino, 2017).

Expectations were also connected to changes in workplace relationships and occupational roles. Worker 9 described how machine-paced production had individualized tasks and reduced the direct coordination previously required among colleagues. This change was experienced not only as an alteration of workflow but also as a transformation of workplace culture. Worker 2 anticipated that automation might eventually reduce traditional activities such as manual quality control, while simultaneously recognizing the continuing importance of human labor: *'In the future, machines will do the work of humans, but there is still much work to be done*

manually in this factory.’ Rather than representing an exaggerated image of technological change, this statement reveals a tension between an anticipated future of extensive automation and the participant’s observation that present production remains dependent on manual work. Gender differences also appeared in how some participants discussed technological futures, although these patterns must be interpreted cautiously given the small qualitative sample. Some interviewed women placed greater emphasis on employment stability and their access to technology-related roles, while several male participants more frequently discussed automation in terms of productivity and performance. These differences do not establish a general gender pattern but suggest that workers’ expectations may also be shaped by their existing positions, task allocation, and access to training within the workplace.

Overall, the workers’ perspectives were neither wholly resistant to nor uncritically supportive of automation. Their expectations combined recognition of efficiency gains with uncertainty about changing skill demands, workplace relationships, and career continuity. The SoE perspective helps show that workers do not respond only to technologies already present in the factory; they also interpret automation through narratives about what industrial work may become and where they expect to be positioned within that future. The contrast with policy and corporate narratives of efficiency shows that workers also considered automation through its effects on daily work, relationships with colleagues, and their future place in the workplace.

4.2.1.7 From Policies to Production: The Blue-Collar Lens on Government and Corporate Strategies

Blue-collar participants experienced automation primarily through changes in their daily work rather than through direct knowledge of the government policies or corporate strategies guiding technological investment. Their awareness of these broader processes was generally limited and indirect, varying according to their educational backgrounds, workplace experience, and the information communicated by managers and white-collar employees.

Some participants associated automation investment with government support and national initiatives aimed at modernizing production. However, only a small number referred to specific policies or programs. Most participants described government involvement as remote from their everyday working conditions and could not clearly distinguish between investments encouraged by public policy and those introduced through company-level cost or productivity strategies. Within their accounts, government policies were therefore visible mainly through perceived indirect consequences rather than as clearly identifiable interventions in the workplace.

Corporate decisions were more visible to participants because they were associated with changes in task allocation, production processes, training requirements, and employment expectations. Participants generally described technological investments as top-down decisions communicated through managers and white-collar employees. Although they recognized improvements in efficiency and product quality, some also connected these investments with a continuing need to update their skills. Worker 6 explained, *'We should always learn about technologies; otherwise, we cannot keep up with their speed.'* His account illustrates how company-level technological decisions were experienced as changing expectations regarding workers' skills and responsibilities.

Participants' accounts also suggest that the manner in which companies introduced automation influenced how technological change was interpreted. Workers who received clear explanations and structured support described new systems as more manageable. Worker 8 observed that gradual implementation combined with technical training reduced uncertainty and facilitated the integration of new technologies into everyday work. Other participants perceived a tension between corporate efficiency objectives and employee welfare, particularly when attention to production improvements appeared to exceed the support provided for workers' development and longer-term security.

Although many participants regarded technological change as unavoidable, they expected companies to address its workforce consequences. Worker 7 explained, *'The machines we work with on the production line are part of our job, but our workflow also changes with the machines. We need to learn, adapt to them, and understand them.'* His account reflects a pragmatic acceptance of automation alongside uncertainty about how changing workflows and skill requirements might affect future career paths.

Taken together, participants' accounts reveal a distance between broad policy narratives of technological modernization and the ways automation was experienced on the production floor. Government policies remained largely abstract to the interviewed workers, whereas company-level decisions became visible through changes in tasks, training expectations, and managerial communication. Within the workplaces represented in the study, firms and managers therefore appeared to mediate how broader technological strategies were translated into workers' everyday experiences.

4.2.1.8 Blue-Collar Workers' Suggestions for Integrating Technology

Participants emphasized that the effective integration of automation involved more than installing new machinery. Their suggestions focused on practical training adapted to different

learning needs, clear communication, gradual implementation, and continuing support. Although several regarded technological change as unavoidable, they associated a more manageable transition with organizational practices that enabled workers to understand new systems and retain meaningful roles in production.

Training was central to these accounts, but participants' experiences varied. While some received detailed instruction, others relied more heavily on workplace experience or informal assistance from colleagues. Worker 1 explained that the availability of training did not necessarily make new systems readily understandable: *'When new machinery comes in, we have training. First, managers explain its benefits and how to use it, but when the workflow changes, I sometimes have difficulty understanding the new machinery.'* Participants' accounts therefore distinguished between formal access to training and instruction adapted to workers' educational backgrounds, technological familiarity, and learning pace.

Participants also associated gradual implementation and clear explanation with greater preparedness. Information about why a system was being introduced, how responsibilities would change, and what assistance would remain available appeared to reduce uncertainty. By contrast, rapid implementation with limited explanation increased reliance on informal peer support.

Automation was generally viewed more positively when it complemented human labor and reduced physical strain without disregarding practical knowledge. Worker 10 stated, *'Thanks to the machines, we have a better workflow. The responsibilities are not as physically demanding as before, and some difficult and heavy tasks are no longer part of the workers' jobs on certain production lines. This is good for us.'* This account illustrates a preferred form of automation that improved working conditions while preserving human involvement.

Some participants, including Worker 4, also proposed refresher workshops as systems were updated, indicating that they understood technological adaptation as an ongoing rather than one-time process. Collectively, these suggestions reflect a worker-centered understanding of integration within the sample. Participants' willingness to engage with automation was associated partly with whether they felt informed and supported and could anticipate a continuing role for their knowledge and labor within changing production processes.

4.2.1.9 Conclusion: The Changing Role of Blue-Collar Workers

The interviews indicate that automation was changing the responsibilities, workflows, and skill requirements of the blue-collar workers included in the study. Participants recognized improvements in production efficiency and reductions in physical strain, while some also

described more rigid work rhythms, diminished control over established routines, and uncertainty about the future value of experience-based skills. Automation was therefore experienced not merely as a technical upgrade but as a workplace transition affecting daily responsibilities, professional identities, and anticipated occupational positions.

These experiences varied according to participants' education, technological familiarity, established work experience, responsibilities, and access to understandable training and support. While some associated automation-related learning with access to more technically valued roles, others experienced continuous upskilling as a condition for remaining included in production. None reported automation-related job loss, but several expressed anticipatory uncertainty concerning career continuity and the recognition of manual expertise.

From an SoE perspective, participants' earlier workplace experiences and expectations about future employment informed their present engagement with training and technological change. Their accounts consequently reflected pragmatic but unequal forms of adaptation, shaped not only by the technologies introduced but also by organizational support and workers' opportunities to assume meaningful roles in the transition.

4.2.2 Perspectives from White-Collar Workers

This section analyses the responses obtained through semi-structured interviews with ten white-collar workers, comprising five women and five men. An overview of the participants is presented in Table 6.

Table 6. Demographic Profile of White-Collar Participants

	WORKER TYPE	AGE	GENDER	EDUCATION
1.	White-Collar Worker	29	Female	BA in Social Sciencess
2.	White-Collar Worker	32	Male	BA in Social Sciencess
3.	White-Collar Worker	34	Female	BA in Social Sciencess
4.	White-Collar Worker	36	Male	MSc in Food Engineering
5.	White-Collar Worker	35	Male	BSc in Food Engineering
6.	White-Collar Worker	36	Female	MA in Chemistry
7.	White-Collar Worker	28	Male	BSc in Industrial Engineering
8.	White-Collar Worker	31	Male	BSc in Food Engineering
9.	White-Collar Worker	36	Female	MSc in Food Engineering
10.	White-Collar Worker	32	Female	BSc in Industrial Engineering

Before the interviews, participants were briefly informed about the study and the automation systems relevant to the research. They were also reassured that their responses would remain confidential and would not affect their employment, with the aim of facilitating open communication.

The interviews revealed different experiences of automation in relation to changing professional roles, decision-making, training, career development, and workforce management. Within this sample, participants' accounts varied according to their job functions, educational backgrounds, technological familiarity, and positions within their organizations. The findings are presented thematically below.

4.2.2.1 The Role of White-Collar Workers in Automation

The interviewed white-collar employees described automation as changing their responsibilities as well as their involvement in production and workforce adaptation. Participants working in engineering, human resources, and operational functions occupied different positions in this process. Their accounts indicate that white-collar roles involved combinations of technical implementation, organizational planning, communication, and the management of workplace transitions.

Participants working in engineering and technical functions described responsibilities related to the integration, operation, and optimization of automated systems. These included machinery calibration, quality control, predictive maintenance, data analysis, and production monitoring. Worker 4 explained that quality-control responsibilities had shifted from predominantly manual checks towards automated and AI-assisted monitoring, which required additional technical competencies. Worker 7 similarly emphasized the value of real-time data: *'The quality standards we aim to maintain are improved with the new machines in which the company invests; especially through real-time monitoring, we can follow production processes in greater detail.'* He also associated the increasing use of data analytics with a continuing need for white-collar employees to update their knowledge and learn how to work with new systems. Participants working in human resources described a different form of involvement in automation. Their accounts referred to the use of digital and AI-assisted tools in recruitment, performance evaluation, and workforce analytics within their organizations. Worker 3 considered data-driven systems capable of improving the efficiency of hiring while also raising concerns about the possible depersonalization of workforce management. HR responsibilities were therefore described as extending beyond the use of digital tools to include communication and the management of their organizational consequences. Worker 2 emphasized the importance of communicating with long-tenured employees who felt uncertain about changing skill requirements and job security, and of presenting adaptation as an opportunity for development rather than solely as an obligation.

Some white-collar participants also described acting as intermediaries between new technologies and the production workers expected to use them. Engineers and technical employees translated technological changes into practical guidance, while HR participants supported communication, training access, and workforce adjustment. Worker 8 emphasized that technical information needed to be converted into training that blue-collar workers could understand and apply in their daily tasks. Within these accounts, mediation involved not only transferring technical knowledge but also explaining how technological change would affect different groups and responsibilities within the workplace.

In summary, the interviews indicate that the white-collar participants occupied both implementation and mediation roles, although the form of their involvement varied according to job function. Engineering and technical participants concentrated more directly on automated systems, production data, and operational processes, while HR participants emphasized training, communication, and workforce adjustment. Across these different functions, technological familiarity and the ability to translate automation into organizational practice were described as increasingly relevant. Within the workplaces represented in the study, some white-collar employees were therefore positioned between technological systems, company objectives, and the employees expected to adapt to changing production processes.

4.2.2.2 The Impact of Automation on Workflows and Decision-Making

White-collar participants described automation as affecting both their daily workflows and their decision-making responsibilities. Within their accounts, data-driven tools and automated monitoring supported operational efficiency while also changing the forms of expertise, interpretation, and communication required in their work. Automation was therefore experienced not only as a technical resource but also as part of a broader reorganization of professional responsibilities within the workplaces represented in the study.

Several participants associated data analytics, automated quality control, and real-time monitoring with improvements in workflow efficiency. Participants working in engineering and technical functions described these systems as supporting production standardization, traceability, and the faster identification of problems. Their responsibilities increasingly involved interpreting system reports and production data alongside more conventional forms of oversight. Worker 4 explained that predictive analytics informed decisions about workflow and resource allocation. In these accounts, digital systems expanded the information available for decision-making while also increasing the importance of being able to interpret and evaluate automated outputs.

Participants emphasized that access to automated information did not eliminate the need for human interpretation or manual work. Worker 7 described automation as improving production analysis while remaining dependent on the complementary role of workers: *'Thanks to new technologies, it provides clear data in some production lines and offers more efficient analysis and production than values that are only related to manpower and followed manually. However, it is not possible for production to be completely with machines in any production line in our factory yet. Human power and machines are complementary to each other, and sometimes blue-collar workers have difficulty due to the increase in workload in these changes. The increase in workload in their perception includes the disruption of their routines, learning something new, and the process of adaptation.'*

Worker 7's account connects perceived efficiency gains with the continuing need for human oversight and with the adaptation demands he observed among blue-collar workers. Other participants also referred to possible errors or limitations in machine-generated data. Within these accounts, automated systems supported professional judgment rather than independently replacing it. Decision-making authority was therefore described as being reorganized through the interaction between technical expertise and automated outputs, rather than simply transferred from employees to machines.

Participants working in human resources expressed a more ambivalent view of automated decision-making. Worker 2 described AI-assisted recruitment platforms as making candidate screening faster and potentially supporting more consistent evaluation. At the same time, she was concerned that automated screening could depersonalize recruitment and fail to capture the complexity of individual candidates. Similar concerns were expressed about data-based performance metrics, which could facilitate employee monitoring while overlooking qualitative dimensions of performance. For these participants, administrative efficiency did not remove the need for contextual human judgment in decisions concerning employees.

Changes in workflow also increased the communication and training responsibilities described by some white-collar participants. As technical employees and production managers interpreted system outputs, they were also expected to explain new processes to the workers using them. Worker 9 emphasized that the benefits of new machinery could not be separated from the way technological changes were communicated: *'Explaining the benefits of the new machines, training users, communicating in their understanding, and demonstrating how the machine can improve their workflows is just as important as the machine's benefits.'* His account illustrates how interpreting data and systems could be combined with responsibility for supporting workforce adaptation.

Collectively, participants associated automation with faster access to information and a greater use of data in operational and organizational decisions. However, their accounts also indicate that these developments could create dependence on system outputs and raise concerns about the continuing place of contextual knowledge and professional discretion. Within this sample, automation did not remove white-collar decision-making responsibilities; it changed them by increasing the need to interpret automated information, retain human oversight, and communicate technological decisions across different levels of the workforce.

4.2.2.3 Training, Skill Adaptation and Career

White-collar participants described automation as changing skill requirements and making training and continuing adaptation increasingly important to professional development. Within their accounts, new technologies introduced different learning demands according to job function, professional experience, and previous technological exposure. The transition therefore involved not only adopting new tools but also developing new forms of expertise and reconsidering the skills associated with career advancement.

Participants working in engineering and production functions described structured training provided through internal company programs or technology suppliers before or during the implementation of automated systems. The training they discussed included software applications, predictive maintenance tools, data analytics platforms, and the operation of particular technologies. Worker 5 also connected white-collar training with responsibility for supporting blue-collar adaptation: *'Our work is to understand the technology; we are also responsible for the adaptation of the blue-collar workers. If we don't understand well, how can we train and manage the adaptation process? We should be the role models of the other workers with our motivation and capacity; our position in production is kind of a leader for the blue-collar workers as well.'* His account illustrates how training could expand both technical knowledge and responsibility for translating new systems into practical guidance for other employees.

Participants also associated technological competence with changing career opportunities within the companies studied. Worker 3 observed that employees familiar with automation-related software and data-driven decision-making were increasingly considered for leadership responsibilities. Some participants therefore regarded training as an opportunity to develop their professional position and gain access to more analytical or technology-related tasks. At the same time, their accounts suggest that greater emphasis on digital competencies could reduce the perceived value of some forms of established expertise.

Experiences of continuous adaptation were not uniform. Participants with greater familiarity with digital technologies generally described training more positively and connected it with skill development or career mobility. Some participants with longer professional experience, however, described the continuing requirement to learn new systems as a source of pressure. Worker 6 noted that the speed of technological change could create uncertainty about maintaining professional relevance even after employees had adapted to existing automated processes. Within this sample, these differences appeared to reflect variations in career stage, job function, and technological exposure rather than a clear generational division.

Participants working in human resources emphasized structured, continuing, and inclusive approaches to training. They connected access to learning opportunities with workforce adaptation, employee retention, and professional stability. The interviews also indicate that technical content alone did not determine how training was experienced. Participants emphasized the importance of explaining how a new technology would affect existing responsibilities and workflows. Worker 9 explained: *'Some employees may be hesitant to undergo training because their routines were disrupted when they learned about the arrival of a new machine. To address this reluctance and uncertainty, it is crucial to communicate openly about how the machine will benefit their work and streamline their tasks. When this communication is clear and effective, training can be more successful, as employees will be more receptive to learning and adapting.'* His account shows that communication was understood as part of the training process rather than as a separate organizational activity.

Several participants remained optimistic about the professional opportunities they associated with automation. Worker 4 described a shift from routine quality checks towards more advanced analytical evaluation, which he connected with an expansion of technical expertise and possible career opportunities. However, the perceived benefits of automation-related learning depended on whether training was accessible, practically relevant, and connected to employees' existing responsibilities.

Overall, the interviews indicate that training served both as a mechanism of professional development and as a source of differentiation among the white-collar participants. It could provide access to technical competencies, analytical responsibilities, and technology-related decision-making, while the continuing expectation of upskilling could also create pressure for employees whose established expertise was less closely connected to emerging digital requirements. Within the workplaces represented in the study, the value of training therefore depended not only on its availability but also on its clarity, practical relevance, and relationship to employees' anticipated professional roles.

4.2.2.4 Job Security, Stability and Workplace Hierarchies

None of the interviewed white-collar employees reported automation-related job loss in the companies included in the study. Nevertheless, several participants described uncertainty about whether they could maintain professional relevance, decision-making influence, and opportunities for advancement as technological requirements changed. Worker 6 observed that employees who experienced difficulty adapting were not necessarily dismissed but could become less involved in strategic decisions. Within these accounts, professional security concerned not only continued employment but also the ability to retain an influential and professionally valued position.

Participants associated technological familiarity with differences in the responsibilities assigned to employees. Worker 4 observed that employees who used automation-based analytics and process-optimization tools effectively were more likely to receive complex or high-responsibility tasks in his workplace. By contrast, employees with less familiarity with these systems could remain concentrated in more routine functions. These accounts suggest that technological competence could affect who received greater responsibility and influence at work, even when employees with different levels of competence remained employed.

Participants working in human resources also discussed differences in technological adaptation among the production workers they supported. Worker 3 described the feedback received from white-collar employees responsible for training production workers: *‘Some workers, especially the younger ones, are learning the new machines faster. We receive this feedback from our white-collar workers who manage the training. The older workers are open to changes, but they may learn more slowly. For this reason, we focus on managing the training sessions carefully.’* This statement represents feedback reported to Worker 3 rather than direct evidence of a general age-based difference. It nevertheless illustrates how perceived differences in learning speed became an organizational issue that HR and technical employees were expected to manage.

Participants also described data-driven systems as changing how managerial authority was exercised. Worker 8 explained that senior managers remained responsible for overseeing large-scale implementation while increasingly using predictive analytics and real-time monitoring to inform their decisions. Some participants regarded these tools as supporting more precise and evidence-based decisions, whereas others were concerned that excessive reliance on automated outputs could reduce the influence of professional experience and contextual judgment. Within

their accounts, data-driven systems supplemented managerial authority while also changing the information on which decisions were based.

Automation-related implementation was further associated with increased coordination across engineering, HR, production, and management functions. Worker 5 noted that these departments needed to work together to align technological implementation with workforce adaptation. Participants considered this collaboration capable of supporting more integrated decision-making, although some also associated changing departmental boundaries with uncertainty about responsibility and authority. These accounts suggest that cross-functional technological expertise was becoming an additional influence on workplace relationships alongside established departmental roles and professional experience.

Several participants regarded career stagnation or declining professional influence as more immediate concerns than the loss of formal employment. Worker 2 observed that some employees could remain employed while gaining less access to new responsibilities and advancement opportunities. Worker 7 similarly connected technological learning with career opportunity: *'Some workers are more interested in learning about the new machine on the production line and wish to take on more responsibility. These workers, in particular, view knowledge of new technologies as an advantage in their careers.'* His account suggests that engagement with automation could provide greater responsibility and visibility for some employees, although the interviews do not establish that technological competence consistently produced career advancement.

Some participants also considered possible longer-term consequences for white-collar employment. Worker 9 anticipated that greater reliance on AI-assisted decision-making might eventually reduce the number of managerial positions required in large-scale food production. This represented a future-oriented concern rather than an employment outcome observed in the companies studied. It indicates that some participants did not regard white-collar positions as permanently protected from technological restructuring, even though no immediate displacement was reported.

In summary, participants described job security in relation to professional relevance, decision-making access, and career continuity as well as formal employment. Their accounts suggest that technological competence was becoming an additional factor in the distribution of responsibilities, while data-driven systems and cross-departmental coordination were influencing established forms of workplace authority. Within the white-collar sample, automation was therefore associated with possible changes in professional influence and career opportunity without having directly eliminated the positions represented in the study.

4.2.2.5 Strategic Decision-Making: Perceived Influence of Government and Corporate Policies

White-collar participants described government support and corporate strategies as factors associated with automation investment and implementation in their workplaces. Although they did not directly formulate government policies or high-level corporate strategies, they experienced how organizational decisions concerning technological investment were translated into operational processes and workforce management. Their accounts therefore provide insight into the perceived workplace implications of policy and corporate priorities rather than an evaluation of the effectiveness of particular government programs.

Several participants regarded public support as facilitating companies' technological investment. Worker 6 referred to tax incentives and digital transformation grants as mechanisms that could encourage the modernization of production lines. From the participants' perspective, such investments supported production efficiency and adaptation to international standards. Some HR participants also associated government-supported industrial transformation with changing recruitment priorities and a growing organizational demand for technologically familiar employees. However, the interviews did not establish whether the companies represented had directly accessed all the programs mentioned or how far particular investments resulted from public incentives rather than company-level decisions.

Participants also perceived a gap between support for technological acquisition and support for workforce adaptation. Worker 4 observed that financial assistance could facilitate the purchase of machinery without providing a corresponding framework for employee training: *'Although different financial supports by the government are available for new machinery in the company, companies need to develop training programs independently and planning for the adaptation process, which will prevent inconsistent adaptation among employees.'* His account suggests that, from the perspective of some participants, investment in technology and preparation of the workforce were not always addressed as integrated parts of the same transformation. Companies were described as retaining substantial responsibility for organizing training and managing differences in employee adaptation.

Corporate strategies were more directly visible in participants' daily responsibilities. Several participants described major automation decisions as being made primarily by senior management, while employees in engineering, HR, and operational functions dealt with the practical requirements of implementation. Worker 8 observed that senior decision-makers often emphasized cost efficiency, whereas employees responsible for implementation

addressed workforce skills, training needs, and compatibility with existing production processes. Within these accounts, limited employee involvement in initial decisions could create a perceived distance between strategic objectives and workplace realities.

Some participants also described a tension between short-term efficiency objectives and longer-term workforce development. They did not report direct job losses resulting from automation in their companies, but some associated technological implementation with increasing expectations that employees continually demonstrate their relevance by acquiring new skills. Corporate strategies were therefore perceived as capable of creating professional pressure even without immediate staff reductions, particularly when training and career development received less attention than operational efficiency.

Participants further discussed the use of data-driven performance measures in recruitment, productivity assessment, and workforce planning. Worker 7 considered automated metrics capable of improving consistency and precision, while questioning whether quantitative indicators adequately represented job satisfaction, professional development, and qualitative aspects of performance. His account illustrates a perceived tension between measurable efficiency and the continuing importance of contextual human judgment in decisions concerning employees.

Other participants evaluated company-level automation strategies more positively when technological investment was accompanied by workforce development. Worker 9 argued that companies investing in employee adaptation alongside automation were more likely to maintain organizational stability. This represented the participant's assessment rather than an organizational outcome measured by the study. Within such accounts, training and skill development allowed automation to be understood as a means of supporting innovation and job quality rather than solely as a cost-reduction mechanism.

Taken together, white-collar participants encountered government policies mainly through their perceived indirect relationship with technological investment, while corporate strategies were more visible through implementation decisions, changing responsibilities, training requirements, and performance measures. Their accounts suggest that the perceived workplace consequences of automation depended partly on how companies connected technological investment with communication, employee participation, and workforce development. These findings concern the experiences of the participants and workplaces included in the study and do not establish the general effectiveness of Turkey's automation policies.

4.2.2.6 Managing Change: Technological Implementation and Employee Experience

White-collar participants described technological implementation as producing both efficiency benefits and organizational challenges. Their accounts indicate that managing automation involved not only integrating new systems but also addressing changing work practices, employee uncertainty, professional judgment, and adaptation pressures.

Participants working in human resources connected change management particularly with employee morale and career expectations. Worker 3 explained: *'Automation has made many administrative tasks easier, but its introduction has also caused concerns among employees, especially about the need to learn new skills. They do not oppose automation; rather, they want to be assured that these changes will not affect their careers negatively or cause uncertainty.'*

This account suggests that hesitation was not necessarily interpreted as opposition to technology but as a response to uncertainty about future roles and skill requirements. HR participants therefore viewed communication as part of technological implementation rather than as a separate organizational concern.

Engineering and technical participants similarly observed that simplifying particular tasks did not necessarily reduce overall workload. Worker 7 associated fewer repetitive activities with increased expectations for precision, monitoring, and continuing adjustment in quality control and production management. Within this account, automation redistributed work and generated new competency requirements rather than simply eliminating existing tasks.

Participants also identified tensions between data-driven processes and professional judgment. Worker 9 explained: *'Automation helps us make more precise decisions based on data; however, it also diminishes some of the individual judgment we used to rely on. Many workers feel that their choices are now evaluated more by algorithms than by their own experience. This reflects the nature of today's technology, which makes our lives easier but also raises concerns. We cannot fully rely on the data if the system is not well-structured, and we must be careful to combine the data with our own analysis for a better understanding.'* Although this account does not demonstrate a uniform workforce response, it illustrates how the informational advantages of automation could coexist with concerns about professional control and the declining recognition of experience-based judgment.

Across the interviews, structured training, accessible support, and transparent communication were associated with more manageable adaptation. Participants also noted that continuing learning requirements could generate stress when organizational support was limited. Worker 8 further argued that employee feedback during implementation could help identify practical

difficulties and clarify changing responsibilities. This represents a participant-supported approach rather than evidence that participatory practices were consistently applied in the companies studied.

Overall, white-collar participants interpreted automation management as both a technical and organizational responsibility. Efficiency gains coexisted with redistributed workloads, adaptation pressure, and concerns about professional judgment. Their accounts suggest that employees judged new systems not only by what the technology could do, but also by how it was introduced and what they expected it to mean for their future responsibilities and influence at work.

4.2.2.7 Conclusion: The White-Collar Workforce as the Bridge in Automation

The interviews indicate that automation was changing the responsibilities and professional expectations of the white-collar employees included in the study. Participants contributed to technological implementation by interpreting data, translating technical outputs into operational decisions, organizing training, and supporting workforce adaptation. Some therefore occupied intermediary positions between technological systems, organizational objectives, and the production workers expected to use new technologies.

This involvement varied according to professional function. Engineering and operational participants engaged more directly with automated production systems, whereas HR participants emphasized recruitment, training, communication, and workforce consequences. Some participants also questioned whether increasingly data-driven processes might weaken contextual human judgment or depersonalize employee relations. White-collar employees consequently did not constitute a uniform group, despite their shared involvement in organizational adaptation.

None of the participants reported automation-related job loss. However, several connected professional security not only with continued employment but also with access to decision-making, complex responsibilities, and career advancement. Automation-related uncertainty therefore concerned the future value of professional expertise and workplace influence.

From an SoE perspective, expectations about future professional relevance informed participants' present engagement with technological change. Although technological competence was generally regarded as increasingly important, participants differed in how they anticipated its effects on career continuity, human judgment, and workplace authority. Their intermediary role was thus shaped by both technological developments and the organizational distribution of implementation responsibilities.

4.2.3 Perspectives from Managers

This section analyses semi-structured interviews conducted with five managers working in Turkey's food sector. The interviews explored participants' experiences of technological adoption, strategic decision-making, and workforce adaptation in the companies and production settings they represented. Particular attention was given to the organizational and financial conditions shaping technological investment, the adaptation of blue- and white-collar employees, and managers' expectations regarding the future of food production.

The interviews addressed two interconnected dimensions: the implementation of technologies already used in participants' organizations and managers' expectations about future technological transformation. Participants discussed existing systems, practical implementation challenges, workforce roles, managerial responsibilities, and sector-specific conditions affecting automation. The semi-structured format allowed them to connect company-level experiences with their broader assessments of technological change in Turkey's food industry.

The findings are presented thematically after an overview of the managerial participants.

Table 7. Demographic Profile of Managerial Participants

	WORKER TYPE	AGE	GENDER	EDUCATION
1.	Factory Manager	37	Male	PhD in Food Engineering
2.	Operations Manager	36	Female	MSc in Food Engineering
3.	R&D Manager	41	Female	MA in Industrial Engineering
4.	Production Manager	44	Male	MSc in Food Engineering
5.	HR Manager	38	Male	BA in Social Sciences

4.2.3.1 Technological Transformation and Managerial Adaptation

The interviewed managers described technological integration as a gradual and complex process involving both perceived efficiency gains and additional managerial responsibilities. Within their accounts, the introduction of digital systems affected decision-making, production oversight, risk assessment, and workforce coordination. Managerial adaptation therefore involved not only understanding new technologies but also assessing their compatibility with existing organizational and production conditions.

Several participants identified quicker access to production information as an advantage of sensor-based systems and real-time monitoring. They described these technologies as reducing reliance on manual reporting and supporting data-informed decisions. At the same time, managers emphasized that access to more data did not by itself ensure effective

implementation. In their view, new systems needed to be integrated carefully into existing operations, as poorly coordinated or premature adoption could create additional inefficiencies. Participants also described automation as affecting particular parts of food production while continuing to operate alongside manual labor. Within these accounts, managerial responsibilities extended beyond technological investment to include employee training, communication, and the coordination of changing roles. Some managers observed differences in employee adaptation according to previous experience and technological familiarity. They therefore described supporting employees who required additional guidance as part of managing technological implementation.

A central concern among the interviewed managers was whether technological investment corresponded with long-term organizational objectives rather than being introduced mainly in response to industry trends. Participants emphasized feasibility studies that considered expected returns, operational requirements, workforce capacity, and organizational readiness. One manager explained: *'We have seen cases where digital initiatives failed to deliver the expected benefits because they were not properly planned, and the organization was not ready for them.'* This account illustrates that managers did not describe technological adoption as inherently beneficial. Its perceived value depended on whether a company had the financial, technical, and workforce capacity to integrate and use the system effectively.

Some participants also identified dependence on external technology providers, system incompatibility, and limited internal expertise as possible implementation risks. They noted that interconnected systems could create new vulnerabilities if a technical failure in one component disrupted wider production processes. Contingency planning, internal technical capacity, and system compatibility were therefore described as managerial considerations. These accounts suggest that participants perceived automation as reducing some operational difficulties while introducing new forms of technological dependence and oversight.

Financial feasibility was another recurring concern, particularly in managers' assessments of mid-sized and locally operating companies. Participants described automation as requiring substantial initial investment and perceived access to public financial support as uneven. One manager stated: *'Investing in automation requires significant initial capital, and while government incentives help, not all companies have equal access to financial resources.'* Participants referred to tax incentives, financing opportunities, and other forms of public support as mechanisms that could facilitate equipment modernization and software integration. However, their accounts represent managerial perceptions of access and usefulness rather than an evaluation of the actual reach or effectiveness of these programs.

Interviewed managers also reflected on how technological transformation affected their own responsibilities and professional development. Some associated digital-transformation projects with new leadership opportunities, while others emphasized the pressure created by the rapid development of AI analytics, cloud computing, and digital monitoring. One participant considered technology-driven projects capable of providing women and men with new routes into leadership. This represented an individual assessment and does not establish a wider pattern of gender equality in the sector. More broadly, participants described technological tools as providing new forms of insight while increasing the complexity of managerial decision-making and the need for continuing learning.

Taken together, the interviewed managers described technological transformation as both an opportunity and a source of additional responsibility. Their accounts connected managerial adaptation with interpreting production data, assessing financial and operational feasibility, managing technological risks, coordinating with external providers, and supporting workforce adaptation. Within the companies represented in the study, managerial authority remained important but was increasingly associated with the ability to combine sectoral experience, technological understanding, and organizational readiness.

4.2.3.2 The Position of Industry 4.0 in Turkey's Food Industry: Challenges, Adaptation, and Future Prospects

Most interviewed managers described the integration of Industry 4.0 technologies in Turkey's food industry as gradual and uneven, particularly when comparing food production with sectors such as automotive and white-goods manufacturing. They perceived smaller and locally operating food companies as relying more heavily on conventional and labor-intensive production. Within their accounts, activities involving sorting, cleaning, quality control, and variable raw materials reduced the perceived feasibility of complete automation in particular production processes. These comparisons represent managerial assessments rather than a systematic measurement of technological adoption across industries.

Seasonality was identified by participants as an important condition affecting technological investment in food production. Manager 2 explained, *'Food production is not constant throughout the year; it follows agricultural cycles, which means automation must be carefully planned to avoid inefficiencies.'* Managers described some factories as increasing or reducing production according to agricultural cycles, raw-material availability, and seasonal demand. They observed that a system could be used intensively during peak periods but remain underused during the off-season. From their perspective, these conditions sometimes made

flexible workforce arrangements more practical than high-cost investment in systems that could not be used consistently throughout the year.

Financial feasibility was another recurring concern. Participants described automation, AI applications, and digital-monitoring systems as requiring substantial initial investment, particularly for companies they perceived as operating with limited financial margins. They emphasized feasibility assessments comparing labor costs, expected efficiency gains, raw-material losses, and the likely use of new systems across production cycles. One manager referred to a production process in which manual operation reportedly produced a higher product yield than full automation. This example does not establish that manual production is generally more efficient; instead, it illustrates the participants' argument that the value of automation needed to be assessed according to the characteristics of particular processes.

Interviewed managers also discussed public incentives in relation to technological investment. They referred to tax benefits, insurance-premium reductions, low-interest credit, and support for companies with R&D centers as mechanisms that could encourage modernization. Some participants perceived food production as receiving less attention in digital-transformation policies than sectors they considered more profitable or internationally competitive, including automotive, energy, and construction. Their accounts suggest that public support could reduce some investment barriers while differences in financial and organizational capacity continued to affect how companies approached technological adoption. The interviews, however, did not evaluate the actual distribution or effectiveness of the incentive programs mentioned.

Managers expected human involvement to remain important in quality control, process oversight, and the handling of sensitive or variable raw materials. As one manager explained, *'Automation helps streamline operations, but in food production, human oversight is irreplaceable; machines still can't replicate the precision and adaptability of a trained worker when handling fresh ingredients. In addition, the company's preparation should be well structured, and we need more time to get ready for these kinds of transformations.'* Within the managerial accounts, this continuing reliance on human expertise supported a hybrid model in which digital monitoring, AI-assisted analytics, and supply-chain technologies complemented rather than completely replaced manual processes. Participants also connected this model with the need for employees to learn how to work alongside new systems while retaining practical production knowledge.

Participants described differences in the pace of adoption among the companies and production settings with which they were familiar. They associated these differences with financial resources, organizational readiness, internal expertise, and leadership strategy. One participant

described a gradual implementation model: ‘In our company, we take a cautious approach to digitalization, focusing on pilot projects first. Large-scale changes can be risky if we don’t evaluate their feasibility step by step first.’ From this participant’s perspective, pilot implementation allowed the company to assess the compatibility and perceived value of a technology before making a larger investment.

Overall, the interviewed managers did not anticipate a rapid or uniform transition towards complete automation. Their accounts associated the pace and form of adoption with seasonality, raw-material variability, financial capacity, organizational readiness, access to support, and the continuing value of human expertise. Within the companies and production settings discussed, participants expected digitalization to proceed selectively and incrementally according to the perceived feasibility of particular technologies and processes.

4.2.3.3 Workforce Dynamics: The Impact of New Technologies on Labor

The interviewed managers did not report immediate automation-related reductions in workforce numbers in the companies they discussed. Instead, they described changes in job responsibilities, skill requirements, and workforce-management practices. In their accounts, raw-material variability, quality-control requirements, and the need for operational flexibility meant that food production continued to depend on human labor. Most participants therefore interpreted automation as reorganizing work within the represented companies rather than directly eliminating it.

Managers generally described efficiency and cost management, rather than the immediate reduction of employee numbers, as central objectives of automation. They referred to digital monitoring, AI-assisted analytics, and process-optimization technologies while emphasizing that these systems continued to require human supervision. As one manager stated, *‘We don’t see automation as a replacement for workers, but rather as a tool to enhance efficiency. Machines still need people to monitor, adjust, and manage them.’* Within the companies discussed, participants associated reductions in some manual tasks with responsibilities involving machine operation, maintenance, monitoring, and data analysis.

Seasonal changes in raw-material availability and product demand were also described as affecting workforce planning. Managers explained that changing labor requirements increased the organizational value of employees who could move between production lines or perform different functions. Participants referred to training and reassignment as alternatives to immediate dismissal following the introduction of automated systems. Workers previously performing packaging tasks, for example, could be reassigned to quality control, logistics, or

machine operation. These examples reflect practices reported in the represented companies and do not establish that reallocation consistently prevented displacement across the sector.

Several managers perceived differences in adaptation according to employees' previous technological exposure and familiarity with digital tools. Manager 1 stated, '*Younger employees see these technologies as natural additions to their work environment and display increased confidence in navigating digital systems.*' Another manager explained, '*Older employees are highly skilled in their areas, but they need more time and structured training to feel comfortable with automation tools.*' These statements represent managerial perceptions rather than evidence of fixed age-based characteristics. They suggest that some managers associated different forms of previous experience with different training needs, rather than demonstrating that age itself determined employees' capacity to adapt.

Participants also associated adaptation with education, occupational position, and prior access to technology. In their observations, employees in engineering, technical, or IT-related functions often appeared more familiar with digital systems, while some blue-collar employees with limited technological experience required more practical support. One manager emphasized that hesitation could reflect unfamiliarity rather than opposition to change. These accounts suggest that the interviewed managers did not interpret all adaptation difficulties as resistance and recognized differences in employees' previous opportunities to develop technological familiarity.

Managers 3, 4, and 5 also discussed gender in relation to technological change. Within the workplaces they observed, men remained more visible in some physically demanding production and maintenance roles, while women were involved in certain digital-transformation and technology-planning activities. These observations indicate a pattern within the cases examined rather than a broader sectoral shift. Manager 5 cautioned, '*Technology alone does not eliminate workplace inequalities; how companies implement these changes is just as important.*' His account suggests that participants understood the opportunities associated with digitalization as remaining connected to organizational practices, training access, task allocation, and promotion processes rather than being produced automatically by technology.

Managers also acknowledged concerns about job security and changing skill requirements among the employees they observed. They associated uncertainty particularly with the early stages of implementation and with situations in which workers received limited information about changing responsibilities. Participants therefore emphasized communication about whether automation would reduce particular tasks, create new responsibilities, or require

retraining. These are managerial observations of employee concerns and should not be treated as substitutes for workers' own accounts; nevertheless, they demonstrate how managers understood communication as part of workforce adaptation.

Financial conditions were also connected to workforce planning in managerial accounts. Participants referred to labor costs, inflation, and economic uncertainty as factors they believed increased interest in efficiency-enhancing technologies. At the same time, they emphasized that workforce capacity and training needs should be included in feasibility and return-on-investment assessments. Manager 5 explained, *'Adopting new technology requires alignment with business objectives, workforce skills, and long-term financial strategies. Investing in automation without considering its impact on employees and operational workflows can lead to inefficiencies rather than improvements. The challenge lies not only in acquiring new technology but also in ensuring that it integrates smoothly into existing structures while supporting both productivity and workforce development.'* His account positions workforce development as part of managerial feasibility assessment rather than as a consideration added only after investment.

Collectively, the interviewed managers described technological change in the represented companies primarily as a process of role reorganization rather than immediate workforce displacement. Their accounts emphasized the continuing contribution of human oversight, operational flexibility, and practical production knowledge. At the same time, they acknowledged that access to emerging responsibilities depended partly on employees' existing skills, technological familiarity, training opportunities, occupational positions, and organizational support. These findings represent managerial interpretations and suggest that, within the companies discussed, workforce outcomes were associated not only with the technologies introduced but also with how reallocation, learning, communication, and inclusion were managed.

4.2.3.4 Future Perspectives and Policy Implications

The interviewed managers expected technological adoption in Turkey's food industry to continue gradually while human labor remained important in particular production processes. They associated Industry 4.0 with potential improvements in efficiency, supply-chain management, and international competitiveness, but considered these outcomes dependent on production conditions, workforce preparedness, organizational readiness, and financial capacity. Their future perspectives therefore combined technological optimism with caution regarding the pace and form of transformation.

Several participants argued that policy approaches should recognize the specific conditions of food production rather than directly reproduce models developed for more standardized industries. Human involvement was expected to remain important in quality control, the handling of variable raw materials, and seasonal operations. Manager 2 explained: *'In food production, seasonality presents a significant challenge. Certain months necessitate a considerably larger workforce, making it impractical to invest in rigid automation systems. Instead, companies need adaptable solutions that balance technology with human flexibility.'* This account illustrates an expectation of gradual and hybrid development in which monitoring and optimization technologies complement flexible human labor.

Managers regarded government incentives as potentially important for reducing investment barriers, particularly for companies with limited financial capacity. However, some considered existing support insufficiently attentive to the operational and workforce conditions of food manufacturing. They consequently connected effective policy support with technological investment, employee training, and longer-term workforce development. These accounts reflect participants' assessments and do not constitute an evaluation of the accessibility or effectiveness of particular incentive programs.

Participants also identified R&D centers and cross-institutional collaboration as possible links between technological innovation and sector-specific application. Manager 4 stated, *'R&D investments are crucial for staying competitive, not just in improving efficiency but also in developing sustainable and high-value products. However, without organized collaboration between industry, education, and policymakers, these efforts often stay fragmented and do not achieve their full potential.'* Managers particularly associated such collaboration with food safety, process optimization, product development, and the practical application of research.

Workforce development formed another component of managers' future expectations. Participants perceived differences in employees' digital familiarity and previous production experience as affecting adaptation, although their accounts did not establish a fixed generational division. These perceptions informed their emphasis on differentiated training and reskilling opportunities that recognized employees' different starting points.

Organizational readiness was similarly central to their assessments. Manager 3 described cases in which investment followed industry trends without sufficient consideration of workforce capacity or operational compatibility: *'We have seen companies invest in automation technologies just because of industry trends, without fully assessing whether their workforce is prepared or if the new systems actually fit their operational needs. In some cases, expensive digital infrastructure remains underutilized because other factory departments are not yet*

ready for digitalization, employees lack the necessary training, or the technology itself doesn't seamlessly integrate into existing production workflows.' This account shows how managers evaluated technological investment through its relationship with training capacity, organizational coordination, and existing production systems.

Managers expected global competition to increase interest in smart supply chains, data-driven planning, and AI-assisted quality control. At the same time, they anticipated uneven adoption resulting from differences in finance, infrastructure, and technical expertise, particularly between larger firms and smaller enterprises. Their policy perspectives consequently linked technological development with sector-specific investment conditions, workforce capacity, R&D collaboration, and organizational preparedness.

Overall, the interviewed managers anticipated continuing but selective transformation rather than rapid or uniform movement towards complete automation. The policy implications emerging from their accounts concern the conditions under which they believed digitalization could be integrated into food production; they reflect managerial expectations and assessments rather than independently verified conclusions about policy effectiveness.

4.2.3.5 Conclusion: Managerial Perspectives on Industry 4.0 in Turkey's Food Sector

The interviews with managers revealed a complex relationship between technological transformation, workforce dynamics, and strategic decision-making. Although the interviewed managers recognized the potential benefits of Industry 4.0, they described implementation in the companies and production settings familiar to them as a gradual and context-dependent process requiring feasibility assessment, organizational readiness, and workforce integration. Their accounts therefore reflected cautious optimism rather than an expectation of rapid or uniform automation.

Managers generally described automation as reorganizing labor rather than immediately displacing it. Raw-material variability, hygiene and quality-control requirements, seasonal production, and fluctuating labor demand were perceived as limiting complete automation and sustaining hybrid arrangements involving both technological systems and human expertise. However, managerial perspectives were not uniform. Participants differed in how they distributed responsibility for adaptation between companies and employees and in the emphasis they placed on structured training, employee initiative, and organizational support. From a Sociology of Expectations perspective, anticipated improvements in efficiency and competitiveness informed present investment and workforce-planning decisions (Borup et al., 2006). Nevertheless, managers reassessed these expectations in relation to practical constraints,

including investment costs, production conditions, access to qualified personnel, and training capacity (Geels & Smit, 2000). Their accounts therefore partly reflected the policy-level imaginary linking automation with competitiveness and workforce upgrading, but they did not reproduce it uncritically. Instead, they translated broader technological expectations into company-specific assessments of feasibility, risk, and organizational capacity. Managers therefore weighed what they expected technology to offer against what their companies could afford, introduce, and use within existing production and work arrangements.

4.2.4 Thematic Analysis: Workforce Perspectives on Industry 4.0 in Turkey's

Food Industry

This section compares how the blue-collar workers, white-collar employees, and managers interviewed in this study experienced and interpreted automation. Whereas Sections 4.2.1–4.2.3 presented the perspectives of each participant group in detail, the present section focuses on similarities and differences across occupational positions. Participants generally acknowledged the efficiency potential of automation but differed in how they understood its consequences for employment security, skill requirements, workplace authority, and career development. Interviewed managers placed greater emphasis on organizational implementation and productivity, while employee accounts more directly reflected everyday adaptation, changing responsibilities, and uncertainty about future professional relevance.

Six comparative themes emerged across the interviews: job security, adaptation, training and skill development, workplace hierarchy, emotional responses, and future expectations. The differences identified within these themes were associated with participants' occupational positions, educational backgrounds, technological familiarity, professional experience, and access to organizational support. They represent recurring patterns within the qualitative sample rather than statistically generalizable differences between occupational or demographic groups.

These comparisons also show how participants interpreted present technological changes in relation to anticipated roles, opportunities, and forms of occupational security, providing the empirical basis for the cross-level SoE analysis in Section 4.3.

Figure 5. Thematic Analysis of Workforce Perspectives on Automation



Figure 5 presents the six interconnected themes identified across the interviews, while Table 8 compares how these themes were expressed among blue-collar workers, white-collar employees, and interviewed managers.

Following Table 8 summarizes the principal similarities and differences across the three participant groups. The comparison reflects recurring patterns within the qualitative sample rather than statistically generalizable differences between occupational or demographic groups.

Table 8. Comparative Summary of Workforce Perspectives on Automation

Theme	Blue-Collar Workers	White-Collar Employees	Interviewed Managers	Cross-Group and SoE Interpretation
Job Security	No immediate displacement was reported. Uncertainty concerned the future value of manual skills and continued inclusion in production.	Concerns focused on professional relevance, career progression, and continued access to decision-making.	Managers emphasized workforce reallocation, training, and adaptability rather than immediate workforce reduction.	Anticipated changes in employment and professional value shaped present perceptions of security.
Adaptation	Experiences varied according to technological familiarity, established routines, education, and access to practical support.	Adaptation involved integrating digital tools into professional responsibilities and maintaining technical competence.	Managers emphasized organizational readiness, communication, training, and gradual implementation.	Expectations about future occupational positions were associated with participants' willingness and perceived ability to adapt.
Skill Development	Training could represent either access to more technically valued	Training was generally more structured and was viewed as an	Managers regarded training as an organizational need but differed over the	The perceived value of training depended on its accessibility, relevance, and

	roles or additional employment pressure.	ongoing professional requirement.	division of responsibility between companies and employees.	anticipated career benefits.
Workplace Hierarchy	Technological competence was perceived as becoming more influential alongside manual experience and seniority.	Digital skills increasingly affected access to complex responsibilities and decision-making.	Managers described technological competence as an additional basis for allocating responsibility.	Expectations about future professional relevance influenced perceptions of workplace authority and advancement.
Emotional Responses	Appreciation of reduced physical strain coexisted with concerns about autonomy, established expertise, and future inclusion.	Confidence in automation coexisted with pressure to maintain technical competence and professional judgment.	Managers expressed cautious optimism while recognizing challenges associated with workforce adaptation.	Emotional responses were related to workplace position, perceived control, organizational support, and anticipated futures.
Future Expectations	Participants combined optimism about technical opportunities with uncertainty about the continuing value of existing skills.	Participants generally anticipated greater demand for digital and analytical competencies.	Managers expected gradual and selective technological adoption rather than immediate complete automation.	Different technological expectations informed present approaches to training, adaptation, and implementation.

Note. The table summarizes recurring patterns within the qualitative sample rather than statistically generalizable differences between workforce groups.

4.2.4.1 Job Security: Stability and Uncertainty

None of the participants reported immediate automation-related displacement in the companies included in the study. Nevertheless, employment security was discussed through different forms of anticipatory uncertainty. Blue-collar participants were primarily concerned with their continued inclusion in production and the future value of manual or experience-based skills. White-collar participants more often connected security to professional relevance, career progression, and continued access to decision-making. Interviewed managers approached the issue through workforce adaptability and organizational continuity, generally presenting training and reassignment as alternatives to direct displacement.

These differences reflected participants' positions within organizational hierarchies and their unequal access to technical roles, information, and development opportunities. Participants with technical experience more often connected automation with continued employment or career mobility, whereas those who believed that their established expertise might become less valuable expressed greater uncertainty. From an SoE perspective, job insecurity was therefore produced not only by experienced employment changes but also by expectations about the

future distribution of roles, skills, and authority. Positive attitudes towards automation did not necessarily indicate equally manageable adaptation, since participants differed in their access to training and organizational support.

4.2.4.2 Adaptation: Managing Change in the Workplace

Adaptation was not experienced as a uniform response to technological change. Among blue-collar participants, it frequently involved learning to operate new systems while renegotiating the value of skills developed through manual production and workplace experience. White-collar employees were more likely to describe adaptation as the integration of digital tools into existing professional responsibilities and the continuous updating of technical competencies. Interviewed managers discussed adaptation mainly in terms of organizational readiness, implementation planning, communication, and workforce development.

Across the groups, technological familiarity and access to practical support were more important than occupational category alone. Participants who anticipated that automation would support career continuity or provide access to more valued responsibilities generally expressed greater willingness to engage with new systems. Those who expected technological change to reduce the relevance of their existing expertise described greater hesitation. Earlier work experiences and established routines consequently shaped how participants interpreted new technologies and approached current learning opportunities. These patterns indicate an association between future-oriented expectations and present adaptation strategies rather than a fixed causal relationship.

4.2.4.3 Training and Skill Development: A Divided Experience

Training had a divided meaning across the interviews. For some participants, it offered access to machine operation, monitoring, maintenance, data analysis, or other technologically valued responsibilities. For others, particularly those with less previous exposure to digital systems, training represented an additional requirement for maintaining their current employment position. Blue-collar participants more frequently emphasized practical learning and support from colleagues, whereas white-collar employees generally encountered more structured forms of professional development and viewed continuous learning as part of their occupational role.

The managerial interviews revealed a related difference regarding responsibility for skill development. Although managers generally regarded training as necessary, some emphasized company-led programs, structured communication, and continued support, while others placed greater responsibility on employees to update their competencies. Discussions of training

therefore concerned more than learning to use technology. They also raised the question of how much support companies should provide and how much responsibility employees were expected to take themselves. From an SoE perspective, participants' engagement with training depended partly on whether they expected it to provide meaningful access to future roles. Its value was consequently shaped by accessibility, practical relevance, organizational recognition, and anticipated career outcomes.

4.2.4.4 Changes in Workplace Hierarchy: The Rise of Technological Literacy

Participants across the three groups associated automation with changes in the bases of workplace authority. Among blue-collar workers, technological competence increasingly operated alongside manual experience and seniority in the allocation of tasks and responsibilities. This created opportunities for technically trained workers who became involved in machine operation, monitoring, or assistance to colleagues, while generating uncertainty among participants who felt that long-established production experience was receiving less recognition.

White-collar participants connected hierarchy changes more directly to access to data-driven decision-making and automation-related responsibilities. Engineers and employees with stronger digital competencies were more likely to anticipate access to technically influential roles, whereas some administrative and HR participants questioned how automated evaluation and decision-making might affect established professional judgment. Managers similarly described technological competence as an increasingly important basis for allocating responsibility.

Automation therefore did not simply alter task content; it also affected how participants anticipated professional value, authority, and advancement. These changes were not uniform, because access to technologically valued roles depended on occupational position, training, and organizational decisions. Some women in the sample also described a need to demonstrate their technical competence more explicitly or reported more limited access to technology-related responsibilities. These accounts are analytically relevant as examples of unequal access within the interviewed workplaces but do not establish general gender differences across the sector.

4.2.4.5 Emotional Responses

Emotional responses to automation combined optimism, uncertainty, and pressure rather than forming a simple distinction between acceptance and resistance. Blue-collar participants

valued the reduction of physical strain but sometimes associated automation with diminished control over work processes or declining recognition of established skills. White-collar employees generally expressed greater confidence in the benefits of automation, while also describing pressure to remain familiar with emerging technologies and preserve the role of professional judgment. Interviewed managers tended to express cautious optimism but differed in the extent to which they emphasized employee initiative or organizational support.

These responses were connected to participants' perceived control over technological change and their expectations about its consequences. Participants who associated automation with professional development generally approached it more positively, whereas those who anticipated reduced occupational influence or exclusion from valued responsibilities expressed greater hesitation. Emotional responses were therefore not merely individual attitudes towards technology. They were embedded in workplace position, access to training, organizational recognition, and expectations concerning future inclusion.

4.2.4.6 Future Expectations: A Pragmatic Approach to Automation

Across the three groups, participants generally expected automation to continue but did not anticipate immediate or complete technological replacement of the workforce. Blue-collar participants combined appreciation of reduced physical strain and new technical opportunities with uncertainty about the continuing relevance of existing skills. White-collar employees expected increasing demand for digital, analytical, and technology-related competencies, although some questioned how automation might affect workplace relationships, professional judgment, and career progression. Interviewed managers anticipated gradual and selective adoption shaped by financial capacity, operational needs, and workforce readiness.

The main difference across the groups concerned not whether automation would continue, but how participants imagined their own positions within that future. Expectations of career mobility encouraged engagement with training and new responsibilities, whereas expectations of declining professional value produced greater caution. Managers' expectations similarly informed present approaches to implementation, workforce development, and the allocation of responsibility for adaptation. In this sense, expectations were performative: they contributed to present decisions and orientations even when the anticipated technological future had not yet been fully realized.

The cross-group comparison consequently reveals both alignment and tension. Participants broadly agreed that technological change would remain important to the sector and that new

competencies would be required. However, they differed over who would benefit from the transition, whose existing expertise would retain value, and whether responsibility for adaptation should rest primarily with employees or organizations. These differences provide the basis for the following analysis of how policy and managerial expectations were translated, negotiated, or challenged within workplace experience.

4.3 From Policy Imaginaries to Workplace Experiences: Translation, Alignment, and Tension

The policy documents examined in this study contributed to the construction of a policy-level sociotechnical imaginary in which technological modernization, industrial competitiveness, and workforce adaptability appeared as mutually reinforcing elements of a desirable future (Jasanoff & Kim, 2015). The organizational findings, however, indicate that this imaginary was not transferred directly into workplace practice. Instead, broader expectations were interpreted and modified through organizational priorities, sectoral conditions, and participants' positions within the workplace.

The clearest alignment emerged between policy narratives and managers' expectations concerning productivity, competitiveness, technological upgrading, and the growing importance of workforce skills. Interviewed managers generally accepted that technological transformation would continue and that companies would need to develop their digital capacities. These expectations informed present assessments of investment, training, recruitment, and workforce planning. In this respect, expectations were performative: anticipated future requirements contributed to organizational decisions before the longer-term consequences of automation had become fully visible (Borup et al., 2006).

This alignment was nevertheless conditional rather than complete. Managers translated the policy-level vision through company-specific concerns involving investment capacity, production requirements, seasonal demand, labor costs, access to qualified personnel, and organizational readiness. The policy expectation of technological modernization was consequently reformulated as a gradual, selective, and hybrid process rather than an immediate transition towards complete automation. Managers' accounts did not simply reproduce the policy imaginary; they adapted it to the operational characteristics and perceived constraints of food production.

Workforce adaptability underwent a similar process of translation. Policy documents generally presented reskilling and technological competence as necessary components of modernization.

Within the interviewed workplaces, however, training did not have a uniform meaning. Some participants regarded automation-related learning as an opportunity to gain technical responsibilities and improve their future career prospects. Others experienced continual learning as an additional condition for retaining professional relevance and remaining included in changing production processes. The policy expectation of an adaptable workforce was therefore translated into both opportunity and pressure, depending on occupational position, previous education, technological familiarity, access to training, and anticipated career outcomes.

Workers' accounts also revealed points of tension with the policy imaginary. Some experiences aligned with the anticipated benefits of modernization, particularly where automation reduced physical strain, improved production processes, or created access to technologically valued roles. Other accounts exposed consequences that received less attention in the policy documents, including machine-paced work, reduced social interaction, unequal access to training and technical responsibilities, adaptation difficulties, and uncertainty regarding the future value of existing expertise. These tensions did not generally take the form of opposition to technological development. Instead, participants questioned how the benefits, responsibilities, and risks of transformation would be distributed within the workplace.

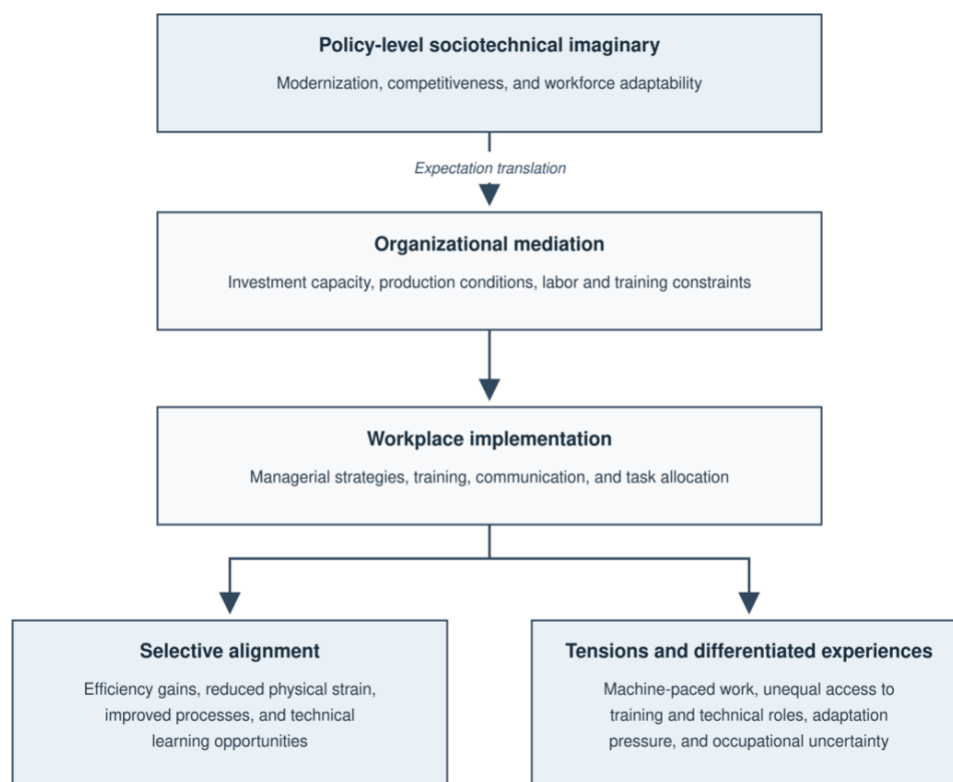
The temporal relationship between previous experience, present expectations, and current action was particularly visible in participants' responses. Earlier experiences of workplace change influenced how some employees interpreted new automation initiatives. Participants who associated technological development with career mobility generally approached training and new responsibilities more positively, whereas those who anticipated declining recognition of their existing expertise expressed greater caution. Hesitation was therefore not necessarily resistance to technology. Earlier workplace experiences could shape whether workers expected to retain a valued place in the future workplace and, in turn, how willing they were to engage with technological change in the present (Brown & Michael, 2003).

These interactions can be understood through Konrad and Alvial Palavicino's (2017) distinction between the governance of expectations and governance by expectations. Policy institutions, companies, managers, and employees all participated in shaping expectations, but they did so from different positions and with unequal influence. Policy narratives and government incentives could encourage technological investment, while managers determined how broader expectations were translated into implementation, training, communication, and

task allocation. Workers' responses could, in turn, influence the pace of adaptation and the forms of organizational support considered necessary. Expectations were therefore produced and negotiated across institutional and workplace levels rather than formed independently within any single group.

Figure 6 summarizes how elements of the policy-level sociotechnical imaginary were mediated through organizational priorities and constraints before becoming visible in workplace practices and workers' experiences.

Figure 6. Analytical Relationship between Policy-Level Sociotechnical Imaginaries and Workplace Experiences



Source: Author's elaboration based on the empirical findings, the concept of sociotechnical imaginaries (Jasanoff & Kim, 2015), and the Sociology of Expectations framework.

Overall, the findings reveal selective alignment rather than either direct policy implementation or complete conflict. Managers broadly shared policy expectations regarding modernization and competitiveness but translated them through assessments of feasibility and organizational capacity. Workers similarly recognized potential technological benefits while questioning whether adaptation processes would preserve their skills, authority, and future occupational

positions. The policy-level imaginary of a technologically advanced and adaptable workforce was therefore enacted unevenly within the selected company settings.

This cross-level interpretation concerns the documents, participants, and organizational contexts examined in the study. It explains how policy imaginaries were selectively translated within particular workplace settings rather than evaluating policy implementation across Turkey's food industry as a whole.

4.4 Sociological Insights into the Future of Labor in Turkey's Food Industry

The effects of Industry 4.0 and automation on labor are not solely economic or technological. Within the food-production workplaces examined in this study, technological transformation was associated with changes in job responsibilities, skill requirements, workplace relationships, professional authority, and perceptions of employment security. The findings therefore indicate that the consequences of automation cannot be understood only through productivity gains or the numerical risk of job displacement. They must also be examined through changes in the organization, quality, and perceived meaning of work.

Automation technologies, including IoT-based devices, robotic systems, and artificial intelligence applications, can transform production, monitoring, and quality-control processes in the food sector (Kusiak, 2018; Tao et al., 2019). However, the findings suggest a gradual and differentiated transformation rather than the direct replacement of workers by machines. None of the interviewed participants reported immediate automation-related displacement in the companies represented in the study. Instead, automation was associated with the redistribution of tasks, workforce reallocation, changing competency requirements, and uncertainty regarding the future value of existing skills. These consequences varied according to occupational position, education, technological familiarity, and access to organizational support. Blue-collar participants with less formal education more frequently described adaptation difficulties, while technically familiar employees generally approached automation with greater confidence. White-collar participants were more likely to associate automation with analytical responsibilities and career development, but also experienced pressure to update their competencies and remain professionally relevant. These patterns support Autor's (2015) emphasis on task transformation and the differentiated consequences of technological change across occupational groups, while also illustrating how technological opportunities may be accompanied by new pressures on employees whose skills are perceived as less compatible with automation (Brynjolfsson & McAfee, 2014).

Adaptation involved more than the acquisition of technical skills. Participants connected technological change with autonomy, workplace interaction, professional identity, and control over work. Some blue-collar workers welcomed the reduction of physically demanding and repetitive tasks, whereas others associated machine-paced production with reduced control over established routines and less interaction with colleagues. Among white-collar participants, data-supported systems improved the speed and precision of certain decisions but also raised concerns about excessive reliance on automated outputs and the declining recognition of contextual human judgment. Training could mitigate these pressures, but its benefits were not distributed equally. Employees who acquired automation-related competencies more readily could gain access to technically valued tasks and responsibilities, while those requiring more time or practical assistance were more likely to express uncertainty about their future position. Automation therefore affected not only what employees did but also whose knowledge retained authority and who could access valued responsibilities within the changing organization of work.

Technological transformation also interacted with existing organizational inequalities. Some participants aged over 40 who had less formal education described needing additional time and practical assistance when learning new systems. However, the interviews did not establish age as an independent explanation for adaptation differences, since it intersected with education, occupational experience, technological familiarity, and access to support. Some interviewed women similarly referred to unequal access to technical responsibilities or to a perceived need to demonstrate their technological competence more explicitly. Given the limited qualitative sample, these accounts do not establish broader demographic patterns across Turkey's food industry. They nevertheless suggest that automation may reproduce or intensify inequalities when opportunities for training, task allocation, participation, and professional recognition are already distributed unevenly.

Participants' concerns were consequently more anticipatory than based on experienced job loss. Blue-collar workers questioned whether their established skills would retain value as manual tasks were reorganized, while white-collar participants more often expressed concerns about maintaining professional influence, decision-making authority, and opportunities for career progression. Job insecurity therefore extended beyond the possibility of unemployment to include anticipated career stagnation, declining authority, and exclusion from technologically valued responsibilities. This also explains why hesitation towards automation should not automatically be interpreted as resistance to technological progress. Participants

generally acknowledged the efficiency and quality-related benefits of new systems; their concerns centered on whether their knowledge would remain recognized and whether they would retain a meaningful position within changing production processes. Their responses thus reflected different expectations concerning future inclusion, authority, and professional relevance rather than a simple division between positive and negative attitudes towards technology.

At the same time, the operational characteristics of food production constrained the extent to which human labor and expertise could be removed. Participants continued to associate quality control, variable raw materials, seasonal production, contextual decision-making, and production flexibility with a need for human oversight. The workplaces represented in the study therefore reflected a hybrid labor structure in which technological literacy acquired greater importance without eliminating the value of practical experience, flexibility, and human judgment. From a sociological perspective, the central issue is consequently not simply whether automation creates or eliminates jobs, but how it redistributes tasks, skills, authority, security, and opportunities within the workplace. The future of labor in these settings is likely to involve continuing negotiation between technological capabilities and human expertise: automation may reduce physical strain, support decision-making, and create new technical responsibilities while simultaneously generating adaptation pressure and uncertainty about the future value of existing knowledge. Its social consequences therefore depend not only on the technology introduced, but also on how workplace relationships change, who more likely receives opportunities to learn and participate in decisions, and whose knowledge and role remain valued.

5. Summary and Conclusion

5.1 Summary of Findings

This study examined how Industry 4.0 technologies and automation were experienced and interpreted within selected food-production workplaces in Turkey. Drawing on interviews with blue-collar workers, white-collar employees, and managers, together with an analysis of policy documents, it investigated technological transformation across workforce, organizational, and policy levels. The findings show that adaptation to automation was not solely a technical process. It involved changes in tasks, skill requirements, work rhythms, workplace relationships, professional authority, and expectations concerning future occupational positions.

Regarding the first research question, the findings indicate that employees experienced automation primarily through task transformation rather than immediate labor displacement. None of the interviewed participants reported losing their employment directly because of automation in the companies represented in the study. Blue-collar participants recognized benefits such as increased production efficiency, greater consistency, and the reduction of physically demanding or repetitive tasks. However, some also associated automated production with more rigid work rhythms, reduced control over established routines, and weaker interaction with colleagues. White-collar participants more often connected automation with analytical responsibilities, technological implementation, and professional development. At the same time, they expressed concerns about the future recognition of contextual judgment, established expertise, and professional influence as reliance on automated outputs and performance metrics increased.

Employment continuity therefore did not eliminate insecurity. Participants' concerns were predominantly anticipatory and related not only to possible job loss but also to the future value of their skills, access to technologically valued responsibilities, decision-making authority, and longer-term career continuity. Technological learning could consequently be understood both as an opportunity to acquire new responsibilities and as a requirement for remaining occupationally relevant. Participants' responses did not reflect a simple division between acceptance and resistance. Instead, they reflected different expectations concerning whether employees would retain a meaningful and recognized position within changing production processes.

Regarding the second research question, automation was found to reshape workforce structures through the redistribution of tasks, responsibilities, skills, and forms of professional authority. Adaptation differed both between and within occupational groups according to educational background, technological familiarity, occupational responsibilities, involvement in implementation, and access to organizational support. Training played an important but ambivalent role in this process. It could facilitate participation in emerging technical tasks, yet its benefits were not distributed equally because employees differed in their previous experience, learning needs, and access to practical assistance. Training could therefore help employees adapt while also contributing to differences in who could take on new responsibilities.

The interviewed managers generally described technological adoption as gradual, selective, and dependent on organizational and sectoral conditions. Their assessments included financial capacity, workforce readiness, compatibility with existing production systems, and access to technical expertise. The operational characteristics of food production including variable raw materials, seasonal requirements, quality control, and the need for production flexibility also constrained the extent to which human labor could be removed. Managers consequently anticipated a hybrid production structure in which automation would operate alongside practical experience, contextual decision-making, and human oversight. Although reassignment and training were described as responses to changing task requirements, these accounts do not establish that such measures consistently prevented displacement or provided equal access to emerging technical roles across the sector.

Regarding the third research question, the selected policy documents articulated a sociotechnical imaginary connecting digitalization, industrial modernization, competitiveness, and workforce adaptability with national development. The interviewed managers broadly aligned with these expectations but interpreted them through the financial, operational, and workforce conditions of their organizations. Comparison with workers' accounts revealed selective alignment rather than direct policy transfer: anticipated benefits such as efficiency gains and new technical responsibilities coexisted with machine-paced work, adaptation pressure, unequal access to valued responsibilities, and uncertainty regarding the future recognition of existing expertise. The study does not evaluate the overall implementation or effectiveness of national policies. Rather, it demonstrates how policy expectations were interpreted within the organizational settings represented in the research.

Viewed through the Sociology of Expectations, these findings demonstrate that anticipated technological futures influenced present behavior and organizational decision-making. Employees interpreted training, changing responsibilities, and professional development in relation to imagined futures concerning skills, authority, and employment. Managers' expectations similarly shaped assessments of investment, implementation, and workforce preparation. Expectations were therefore more than predictions: they helped shape how managers approached technological investment and how employees responded to changes in their work.

Collectively, the findings challenge interpretations of automation as either a direct mechanism of labor replacement or an inherently beneficial technological solution. The central argument of this dissertation is that automation in the food-production workplaces examined reorganized labor through uneven processes of expectation, translation, and adaptation. It transformed tasks, skills, work rhythms, authority, and occupational security more visibly than it eliminated employment. Policy imaginaries of modernization and adaptability were selectively translated through organizational conditions and experienced by workers as both opportunity and anticipatory pressure. As a qualitative study of selected workplaces and policy documents, these findings are contextually grounded and do not constitute a representative assessment of Turkey's food industry as a whole.

5.2 Limitations of the Study

This study examines how new technologies and automation systems are being integrated into selected food-production workplaces in Turkey within the framework of Industry 4.0. While it provides detailed qualitative insights into the relationship between labor and technological transformation, several limitations should be considered when interpreting the scope and implications of the findings.

5.2.1 Scope and Transferability of the Study

This research focuses specifically on food production in Turkey and does not examine other industrial sectors or national contexts. This intentional focus made it possible to explore the characteristics of a sector shaped by seasonal production, variable raw materials, quality-control requirements, and the continuing importance of human involvement in particular processes. However, these characteristics also limit the extent to which the findings can be transferred to industries such as automotive, textiles, or white-goods manufacturing, where production processes, workforce structures, and levels of automation may differ.

This study examined two organizational sites belonging to the same business group and therefore captures a bounded set of workplace and managerial experiences. Differences across regions, food-production subsectors, company sizes, ownership structures, and technological configurations may produce other patterns of implementation and workforce adaptation. The qualitative and purposive design was intended to generate contextually detailed and analytically transferable insights rather than statistically representative estimates of Turkey's food industry. Consequently, the findings may inform comparisons with similar organizational contexts, but their relevance to other settings should be assessed in relation to those settings' institutional, technological, and workforce characteristics.

5.2.2 Sample Size and Participant Selection

The research involved semi-structured, in-depth interviews with a purposively selected group of blue-collar workers, white-collar employees, and managers. This approach provided detailed accounts of how participants in different workplace positions experienced and interpreted automation. However, the relatively small qualitative sample does not capture the full range or prevalence of perspectives within Turkey's food-production industry.

Although participant selection aimed to include different occupational positions, educational backgrounds, ages, and levels of technological familiarity, the sample was not designed to support statistical comparisons among demographic or occupational groups. Patterns connected to age, gender, education, or job position should therefore be interpreted as differences observed within the sample rather than as evidence of general differences across the sector.

Access to participants and companies may also have influenced the composition of the sample. Employees who were available or willing to participate may have had different experiences from those who did not take part. Moreover, the accounts of blue-collar workers, white-collar employees, and managers should not be treated as directly matched assessments of every technological change or workplace event. The comparative analysis identifies recurring similarities and differences across participant groups, but it does not establish causal relationships among occupational position, demographic characteristics, and attitudes towards automation.

5.2.3 Workplace Sensitivities and Researcher Influence

The study addresses sensitive issues, including job security, workplace authority, company strategies, working conditions, and uncertainty about future automation. Some participants

may have hesitated to express critical views because of concerns about how their statements might be interpreted within their workplaces. This possibility was particularly relevant for employees discussing company decisions or the future security of their roles.

Participants were informed that their responses would remain confidential and would not affect their employment. Nevertheless, assurances of confidentiality cannot entirely eliminate the influence of workplace hierarchies or perceived employment risks. These sensitivities may have affected the depth and openness of some responses, especially where participants discussed management decisions, training practices, or concerns about technological change.

The researcher's presence and the semi-structured interview format may also have shaped how participants presented their experiences. Follow-up questions supported detailed exploration but could have influenced which aspects of automation received greater attention. Although efforts were made to remain neutral and allow participants to develop their own accounts, the interpretation of qualitative material inevitably involved analytical decisions during coding, thematic comparison, and the presentation of findings.

5.2.4 Methodological and Comparative Constraints

The study prioritized qualitative depth to examine how workers and managers understood and anticipated technological change. This approach made it possible to explore experiences of adaptation, uncertainty, professional identity, and changing workplace relationships that may be difficult to capture through standardized measures. However, the research did not include a large-scale survey, long-term workplace observation, or quantitative measures of employment change, productivity, training outcomes, or automation intensity.

As a result, the study cannot determine the statistical prevalence of the patterns identified in the interviews or independently measure the operational effects of the technologies discussed. Participants' accounts of efficiency, workload, training, workforce reallocation, and organizational support represent their experiences and assessments. They should not be treated as independently verified evaluations of company performance or technological outcomes.

The study also draws on accounts from participants occupying different organizational positions. This supports comparison across workforce groups, but differences in authority, access to information, and professional responsibilities influenced what participants could observe and discuss. Managerial accounts of employee adaptation, for example, provide information about managers' perceptions but cannot substitute for workers' own accounts.

Similarly, employees' interpretations of corporate strategies do not necessarily reflect the full decision-making processes through which technological investments were selected.

5.2.5 Policy Documents and Data Availability

The research also encountered limitations in the availability of sociological and sector-specific evidence concerning labor and automation in Turkey's food industry. Existing research has more frequently examined technological capacity, productivity, and economic implications than workers' everyday experiences of automation. This limited the possibilities for comparing the interview findings with a larger body of sector-specific sociological research.

The reviewed policy documents provided information about official priorities concerning digital transformation, vocational training, technological investment, and workforce development. However, policy documents primarily present institutional objectives, planned measures, and expected outcomes. Their inclusion does not establish how consistently these policies were implemented, how accessible particular support programs were to different companies and employees, or whether their stated objectives were achieved.

The interviews offered insight into how some managers perceived public incentives and institutional support, but they did not constitute an independent evaluation of national policy implementation. The study therefore identifies a relationship between policy narratives and company-level accounts without claiming to measure the overall effectiveness of Turkey's Industry 4.0 or workforce policies.

5.2.6 Contextual, Temporal, and Theoretical Limitations

The interviews reflect participants' experiences and expectations during a particular period of technological and economic change. Automation systems, company strategies, labor-market conditions, and policy priorities may continue to develop, meaning that the findings cannot fully capture how participants' roles and expectations may change over time. Because the research was cross-sectional, it was not possible to follow whether anticipated job changes, training outcomes, or workforce-reallocation strategies later occurred as participants expected.

The findings were also shaped by Turkey's economic, cultural, organizational, and policy context. Differences in labor regulation, industrial structure, workplace culture, technological capacity, and access to public support limit direct comparison with other countries or regions. The designation of Turkey as a developing or transitional context should therefore not be

treated as a sufficient explanation for the experiences identified in the interviews; the specific company and sectoral conditions represented in the study remain important.

The Sociology of Expectations provides a useful framework for examining how anticipated technological futures influence present interpretations and actions. However, a future-oriented framework may place greater analytical attention on expectations and narratives than on other dimensions of workplace power and worker agency. This limitation requires caution when interpreting participants' expectations as explanations of their actions. The relationship between expectations, material workplace conditions, organizational authority, and employees' capacity to influence technological implementation cannot be fully established through the interview material alone. Accordingly, participants' expectations are interpreted in relation to material workplace conditions, organizational authority, and employees' capacity to influence technological implementation rather than as independent explanations of action.

Despite these limitations, the study provides contextually grounded insights into how workers and managers in the selected food-production settings experienced and interpreted automation. The findings should therefore be read as an analysis of situated workplace experiences, organizational practices, and future-oriented interpretations within the cases studied. The limitations identified here also establish the basis for the recommendations for future research presented in Section 5.5.

5.3 Contributions to the Field

The dissertation contributes to research on automation and labor by examining workers' and managers' experiences alongside policy expectations in Turkey's food industry. This places the changing experience of work at the center of the analysis. This multi-level approach makes it possible to examine technological transformation not only as a change in production capacity but also as a process shaped by workplace position, organizational authority, sectoral conditions, and expectations about the future.

Empirically, the study extends employment-centered debates on automation by showing that technological transformation may produce significant changes in occupational security and professional position even in the absence of reported immediate displacement. Within the cases examined, anticipatory insecurity concerned the future value of skills, access to technologically valued responsibilities, professional authority, and opportunities for career continuity. This broadens the sociological understanding of job security beyond continued employment and

demonstrates why estimates of jobs created or eliminated cannot fully capture the workplace consequences of automation.

The comparison among occupational groups provides a further contribution. By examining blue-collar workers, white-collar employees, and managers within related production contexts, the study shows how the meaning of automation varies according to participants' positions in organizational hierarchies and production processes. Differences in expectations were connected to forms of knowledge, access to information, technological familiarity, decision-making authority, and involvement in implementation. The analysis also avoids treating occupational groups as internally uniform by identifying variation within them. This comparative design provides a basis for examining how technological change redistributes not only tasks and skills but also influence, recognition, and access to emerging opportunities.

The dissertation also contributes to sociological research on the quality and organization of work under technological change. It demonstrates the importance of examining work rhythms, autonomy, social interaction, practical knowledge, and professional judgment alongside productivity and employment outcomes. Automation may reduce physical strain and support more precise decision-making while simultaneously making some work processes more rigid or altering the authority attached to experience-based knowledge. The contribution therefore lies in showing how beneficial and disruptive consequences can coexist within the same technological transition and be distributed unevenly across workplace positions.

Theoretically, the application of the Sociology of Expectations demonstrates how anticipated technological futures become part of present workplace action. The analysis connects previous experiences and imagined futures with current responses to training, changing responsibilities, and technological implementation. Expectations of career mobility or future inclusion may encourage engagement with technological change, whereas expectations of declining professional value may generate caution before employment consequences become visible. This supports an interpretation of expectations as performative and socially situated rather than as neutral forecasts or individual attitudes towards technology.

By combining the Sociology of Expectations with sociotechnical imaginaries and integrating policy-document analysis with workplace interviews, the dissertation extends this theoretical contribution across policy, organizational, and workforce levels. It distinguishes policy-level visions from implementation and shows how expectations concerning modernization, competitiveness, and workforce adaptability were selectively interpreted through financial

capacity, production requirements, organizational priorities, and workforce readiness. Workers, in turn, experienced adaptability as both an opportunity for professional development and a condition for retaining occupational relevance. This multi-level analysis contributes a framework for examining alignment, translation, and tension between desired technological futures and the workplace processes through which they are selectively enacted.

A further contextual contribution arises from the focus on Turkey's food-production industry, where sociological research on workplace experiences of Industry 4.0 remains comparatively limited. The findings demonstrate the importance of examining automation in relation to sector-specific conditions such as seasonality, raw-material variability, fluctuating demand, quality-control requirements, and the continuing need for operational flexibility and human judgment. These conditions complicate assumptions that automation follows a uniform path across industries and help explain why technological transformation may produce hybrid arrangements in which digital systems and human expertise remain interdependent.

Methodologically, the qualitative design provides detailed accounts of uncertainty, adaptation, professional identity, and future orientation that are difficult to identify through aggregate measures of employment and technological adoption alone. Its value lies in comparing how workers, managers, and policy documents present technological change, rather than in producing statistically representative findings. The integration of workplace interviews with policy-document analysis also enables official expectations to be examined without treating policy objectives as evidence of implementation. This design offers concepts and analytical relationships that can be investigated through future research involving other companies, sectors, regions, and national settings.

Overall, the dissertation contributes to the field by demonstrating that the workplace consequences of automation are neither determined by technology alone nor adequately captured through employment numbers. They emerge through interactions among technological systems, task structures, sectoral conditions, organizational decisions, workplace inequalities, and socially constructed expectations. Its principal contribution is therefore a workforce-centered and multi-level account of Industry 4.0 as a transformation of not only the organization and experience of work but also its anticipated future.

5.4 Implications for Policy and Practice

The implications developed in this section arise from the relationship between the reviewed policy documents and the workplace experiences represented in the interviews. Official

documents frame technological transformation, vocational training, and workforce development as interconnected components of industrial modernization. The interviews support the importance of this connection but also show that technological investment can produce uneven experiences depending on employees' starting positions, organizational capacity, and sectoral conditions. The implications are therefore considered separately for workers and workforce representatives, managers and companies, and policymakers and educational institutions. They should be understood as contextually grounded implications of the cases examined rather than as universally applicable prescriptions or an evaluation of existing policies across Turkey's food industry.

5.4.1 Implications for Workers and Workforce Representation

The findings indicate that formal access to training did not necessarily produce an equally manageable transition for all employees. Participants entered technological change with different educational backgrounds, levels of digital familiarity, occupational experience, and opportunities to work directly with new systems. Training was described as more useful when it was practical, connected to everyday responsibilities, and responsive to employees' existing knowledge. This suggests that workforce preparation may need to account for different starting points rather than treating adaptation as a uniform individual responsibility.

Participants' reliance on informal assistance also draws attention to the importance of support beyond the initial introduction of a system. Workplace mentoring, opportunities for supervised practice, and continued access to guidance may be particularly relevant for employees who require additional time to become familiar with new technologies. Such support may help employees not only learn to use new systems but also take on new technical responsibilities by giving them opportunities to develop and demonstrate their skills.

The interviews further suggest that employee participation can provide forms of knowledge that are not always visible during technological investment decisions. Blue-collar participants possessed practical knowledge of production processes, while some white-collar employees translated technological requirements into everyday organizational practices. Opportunities to communicate experiences of workflow, machine pace, safety, workload, and changing task allocation could therefore inform implementation. Labor unions or other forms of workforce representation may provide one institutional channel for such participation. However, because the study did not directly examine unions or employee-representation bodies, their current role and capacity in automation processes cannot be assessed from these findings.

5.4.2 Implications for Managers and Companies

Managers' accounts indicate that the feasibility of technological investment depended on more than acquisition costs or projected productivity gains. Participants also evaluated compatibility with existing operations, workforce competencies, internal technical capacity, maintenance requirements, and organizational readiness. Cases in which technologies were reportedly underused illustrate the potential consequences of weak alignment among technical systems, production processes, and employee capabilities. Companies should therefore consider whether employees are prepared and how work will be organized before purchasing new systems, rather than addressing these questions only after the investment.

Sectoral conditions were particularly relevant to these assessments. Seasonality, variable raw materials, fluctuating production demand, quality-control requirements, and the continuing need for operational flexibility limited the suitability of complete or rigid automation in some processes. Participants' accounts therefore support gradual implementation and initial testing as possible ways of assessing organizational compatibility, particularly where firms have limited financial or technical capacity. This implication is especially relevant to small and medium-sized enterprises, although the study does not provide comparative evidence concerning the outcomes of different implementation models.

Workforce reallocation similarly emerged as a process requiring organizational preparation rather than an automatic consequence of automation. Movement into machine operation, monitoring, maintenance, quality control, or logistics depended on accessible training and opportunities to acquire the required competencies. Participants' accounts suggest that the identification of changing tasks and potential transition pathways may help connect technological implementation with the development of the existing workforce.

The continuing importance attached to contextual knowledge and professional judgment also has implications for data-supported decision-making. Participants recognized the speed and precision offered by automated systems but questioned the treatment of their outputs as complete substitutes for experience. This was relevant to production management and quality control as well as workforce decisions such as recruitment and performance evaluation. The findings therefore support an approach in which automated outputs inform rather than independently determine decisions. Clear communication about the purpose of new systems, anticipated changes in responsibilities, and available support may also reduce uncertainty and prevent adaptation difficulties from being interpreted simply as resistance to technology.

5.4.3 Implications for Policymakers and Educational Institutions

The policy documents reviewed in this study recognize both technological investment and skill development, while managers described public incentives, financing, and R&D support as potentially important to company decisions. The interviews nevertheless indicate that access to machinery or digital infrastructure does not ensure effective workforce adaptation. This suggests that investment support should be considered alongside the training and workplace support employees need to use, maintain, and work with new systems.

Public support for technological investment could therefore give greater attention to implementation planning, workforce preparation, and longer-term skill development. The findings do not establish which specific funding arrangements would be most effective. They do, however, suggest that firm size, technological capacity, production type, and workforce composition influence companies' ability to translate investment into sustainable organizational change. Managers' accounts particularly identified financial and technical constraints affecting smaller firms, although broader evidence would be required to evaluate the accessibility and distribution of existing support programs.

The sector-specific character of food production also questions the suitability of uniform models of technological modernization. Programs addressing automation and skills development may need to recognize seasonality, raw-material variability, food-safety requirements, and the continued importance of human flexibility and judgment. Collaboration among vocational-training providers, universities, companies, and R&D institutions could help connect digital literacy and technical education with actual production conditions. The findings further indicate the importance of making such opportunities accessible to employees with different educational backgrounds and levels of previous technological exposure.

Finally, the study suggests that assessments of digital-transformation initiatives could extend beyond the number or monetary value of technological investments. Employee access to training, the use of acquired systems, changes in job responsibilities, and the distribution of emerging technical opportunities provide additional dimensions through which workplace outcomes might be examined. Including the perspectives of workers, managers, employers, and training institutions could help distinguish policy objectives from their varied organizational effects. These implications remain propositions grounded in the documents and workplace accounts examined in this study; evaluating their broader relevance and effectiveness requires further comparative and longitudinal research.

5.5 Recommendations for Future Research

This research examined the relationship between labor, technology, and new automation systems within selected workplaces in Turkey's food-production sector. While its findings provide contextually grounded insights, they also indicate the need for broader research into the workforce consequences of Industry 4.0.

The semi-structured, in-depth interviews used in this study made it possible to explore workers' and managers' experiences, concerns, and expectations regarding automation. Future research could include larger and more diverse samples to examine whether the patterns identified here also appear across companies of different sizes, technological capacities, market positions, and geographic locations. Greater participant diversity could support further analysis of how age, gender, education, occupational position, employment status, and previous technological exposure are associated with experiences of automation. These characteristics should not be treated as fixed explanations but examined in relation to task allocation, training access, workplace authority, and organizational support.

Future studies could also include actors not directly represented in this research, such as labor unions, employee representatives, vocational-training providers, policymakers, technology suppliers, and R&D institutions. Their inclusion could clarify how technological investments and workforce-development strategies are designed and how responsibility for adaptation is distributed among employers, employees, educational institutions, and public organizations.

Longitudinal research would be particularly valuable because the present study examined participants' experiences and expectations during a specific period and could not determine whether anticipated changes later occurred. Following workers, managers, and workplaces over time could show how expectations develop as technologies are introduced, updated, or discontinued. It could also examine whether training and reassignment help employees move into and remain in new roles, and how their sense of employment security changes after new technologies are introduced.

The Sociology of Expectations provides a useful framework for such research because it draws attention to how anticipated futures influence present decisions and actions. Future studies could investigate how expectations concerning automation, skills, and competitiveness shape company investment and employee adaptation, including situations in which expectations are revised, remain unrealized, or produce outcomes different from those initially anticipated. Attention to expectations should nevertheless be combined with analysis of material working

conditions, organizational power, and worker agency. This would help clarify when employees influence technological implementation and when their participation is constrained by workplace hierarchies or employment insecurity.

Cross-national and cross-industry comparisons could further develop this field. Comparisons between Turkey and countries with different labor-market institutions, vocational-training systems, and forms of industrial support could identify how national conditions shape automation, employment security, and workforce development without assuming that a single model of technological transformation can be transferred between countries. Comparisons with industries such as automotive, textiles, chemicals, logistics, or white-goods manufacturing could also distinguish patterns associated specifically with food production including seasonality, raw-material variability, and food-safety requirements from those found more broadly across labor-intensive or increasingly automated sectors.

A mixed-methods approach could provide a broader understanding of labor dynamics under Industry 4.0. Interviews, focus groups, and workplace observations could continue to examine how employees interpret technological change, while surveys and organizational data could assess broader patterns in training access, changing responsibilities, employment security, and technological preparedness. Where access is possible, production and employment data could also be compared with participants' perceptions of efficiency and workforce change. Such methods would complement rather than replace detailed qualitative analysis.

Further methodological attention should be given to workplace sensitivity and participant access. Employees may hesitate to discuss job security, management decisions, or working conditions when research is connected to their workplace. Independent participant recruitment, anonymous surveys, interviews conducted outside the workplace, and third-party researchers could reduce these concerns. Future studies could also compare anonymous and interview-based responses to examine how data-collection conditions influence what employees report.

The relationship between policy objectives and workplace implementation also requires more systematic research. Future studies could examine how firms of different sizes and regions access public incentives, whether technological support is connected to training and workforce-development plans, and how accessible upskilling programs are to different employee groups. They could further assess whether monitoring systems evaluate only technological investment or also consider workforce outcomes, including participation in training, changes in responsibilities and autonomy, employee retention, and career-development opportunities.

Combining employee, employer, union, policy, and educational-institution perspectives would provide a more complete account of whether policy measures correspond with workplace needs.

Finally, future research should continue to give direct analytical attention to workers' perspectives. Rather than approaching automation only as a threat to blue-collar employment or an opportunity for technically skilled workers, field-based research should examine its differentiated consequences for physical strain, work rhythms, professional authority, skill recognition, workplace relationships, and anticipatory insecurity. It should also investigate the extent to which workers can participate in decisions about technological implementation.

Overall, future research could extend the findings of this dissertation through longitudinal, comparative, and mixed-methods designs while continuing to examine how technological expectations interact with institutional conditions, workplace power, and employees' capacity to influence change.

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List of the Author's Publications on the Topic

Sinik, A. (forthcoming): "Labor in Transition: Automation and Social Disruptions in Turkey's Food Industry." *Információs Társadalom*, 2026/3. Accepted for publication on 6 May 2026. DOI forthcoming.

6. Appendices and Supplementary Material

6.1 Interview Questions

Questionnaire for Blue-Collar Employees

1. How would you describe your current job responsibilities and tasks in the food industry?
2. Have you noticed any changes or introductions of new technologies or automation systems in your workplace? If yes, could you please provide some examples?
3. How do you perceive the impact of these new technologies and automation systems on your job security and stability?
4. Have you received any training or support to adapt to the new technologies or automation systems? If yes, please explain what kind of training/support was provided.
5. How do you feel about the use of technology and automation systems in your daily work? Do you think it has improved or worsened the efficiency of your job tasks?
6. Have you observed any changes in the work structure or hierarchy due to the implementation of new technologies or automation systems? If yes, please describe these changes.
7. How do you think the introduction of new technologies and automation systems has affected the overall working conditions and environment in your workplace?
8. Have there been any changes in the skills or qualifications required for your job due to the advancements in technology and automation? If yes, please elaborate on these changes.
9. What do you think/feel (Are you concerned) about the potential impact of automation on job changes, opportunities, or risks in the food industry and your position (career)? Why or why not?
10. Do you have any suggestions or ideas on how to better integrate technology and automation systems into the work processes while ensuring job security and employee well-being?
11. Do you have any governmental policies observations on the governmental policies which affect to your workplace and/or your workflow?
12. If yes, what do you know about the governmental policies on technological innovations, investments, and labor?
13. Do you have any observations on the company strategies related to labor and technological innovations' use in the factory?

14. If yes, could you please share your observations and opinions on the technological investments and innovations?

Questionnaire for White-Collar Employees

Focusing on the Experiences of White-Collar Employees

1. Could you describe your current job responsibilities and tasks in your role within the food industry?
2. Have you observed any changes or the introduction of new technologies or automation systems in your organization? If yes, could you provide specific examples or experiences from your perspective?
3. How do you perceive the impact of these new technologies and automation systems on organizational processes, including your role and the overall work environment?
4. Have you been involved in managing or supporting the adaptation process for new technologies and automation systems? If yes, could you elaborate on your role and the steps taken during these processes?
5. How do you feel about the integration of technology and automation systems in your daily tasks? Do you think these advancements have improved or complicated your workflow and productivity?
6. Have you observed any changes in organizational structures, communication dynamics, or decision-making processes as a result of the implementation of new technologies and automation systems? If yes, please share your observations.
7. How do you perceive the impact of governmental policies on your organization's operations, especially in relation to technological innovation and workforce management? Do you believe these policies influence the way your company integrates new technologies?
8. In your opinion, do company strategies align effectively with technological investments and their impact on both white-collar and blue-collar workers? Could you share examples of successful or challenging scenarios?
9. What do you think about the long-term effects of automation on career opportunities, job responsibilities, and risks within your industry or position? Why or why not?
10. Do you have any recommendations for better integrating technology and automation systems into work processes while maintaining a focus on employee satisfaction, well-being, and efficiency?

Observations of White-Collar Employees on Blue-Collar Workers and Processes

11. In your experience, how do blue-collar workers react to the introduction of new technologies or production lines? Could you provide examples of their responses or concerns?
12. How is the feedback from blue-collar workers about new technologies collected and utilized? Do you play a role in gathering or addressing this feedback? If so, how?
13. How do you and your team manage the training and onboarding processes for blue-collar workers to adapt to new technologies or automation systems? Could you describe the training approaches used and their effectiveness?
14. How do you observe blue-collar workers' adaptability to new technologies? Are there common challenges or patterns you've identified during the adaptation process?
15. From your perspective, what challenges arise during the integration of new technologies and automation systems for blue-collar workers? How does the organization address these challenges?
16. What role does your department or management play in addressing resistance or concerns from blue-collar workers about new technologies? How do you ensure smooth transitions and effective communication?
17. Could you provide specific examples of how new production lines or technologies were introduced and how the processes were managed, particularly regarding blue-collar workers? How did your team or management address their concerns and support them through the change?
18. What strategies are used to evaluate the effectiveness of training and adaptation programs for blue-collar workers? Do you believe these strategies are sufficient?
19. From your perspective, how can the organization improve communication and collaboration between blue-collar and white-collar employees during technological transitions?
20. Do you have any observations on how the introduction of new technologies has affected blue-collar workers' job satisfaction, efficiency, or overall working conditions?

21. In your opinion, what additional support or initiatives could better prepare blue-collar workers for future technological advancements?

Questionnaire for Managers

General Sector View

1. How do you think technological innovations in the food sector are shaping the future of the sector?
2. What does the concept of Industry 4.0 mean to the food sector in your opinion?
3. What advantages or challenges does your company face in the process of adopting Industry 4.0 technologies?
4. How do you evaluate the effects of technology on efficiency, production quality and sustainability in the sector?
5. What fundamental differences do you observe between large companies and SMEs in terms of technological adaptation in Turkey's food sector?
6. What are the effects of the fact that traditional production methods are still widespread in the food sector in Turkey on technological adaptation?

Technological Transformation and Integration

1. Which Industry 4.0 technologies are actively used in your company? (For example: IoT, robotic systems, artificial intelligence, big data, etc.)
2. What were the biggest challenges you encountered during the implementation of these technologies?
3. How do you evaluate the advantages or disadvantages of your company's size (SME or large-scale enterprise) during technology integration?
4. Have you made any changes to your organizational structure to adopt new technologies?
5. What are the biggest benefits of technological transformation on your operational processes?

Workforce Dynamics and Sociological Dimension

- Blue-Collar and White-Collar Workforce

1. What do you think about the adaptation processes of your blue- and white-collar employees to technological transformation?

2. What kinds of reactions have you encountered among employees towards new technologies? (For example, resistance, fear, uncertainty.)
3. How do your employees approach widespread concerns such as fear of job loss or “robots will take our jobs”?
4. What are the new skill needs that have emerged with technological transformation for white-collar employees? How do you support them in this process?
5. How did the transformation of repetitive tasks of blue-collar employees with automation provide a transition to new job roles?

- Workforce and Social Impacts

1. How do you evaluate the social and emotional effects of technological transformation on blue-collar and white-collar employees?
2. Have you encountered any cultural or traditional obstacles in your employees’ adaptation processes to technology?
3. How do you think the workforce in Turkey is ready to adapt to technological changes, especially in the food sector?

Manager Perspectives

- Own Experiences and Future Expectations

1. As a manager, how did you adapt to technological transformation processes? How did this process affect you professionally?
2. What challenges do you face when making strategic decisions with new technologies?
3. How do you see the effects of the Industry 4.0 transformation on your own career? Is this an opportunity or a threat for you?
4. How do you see technology as an opportunity for your future career and your company?

Turkey Context and Sectoral Perspective

- The Position of New Technologies in the Food Sector

1. How do you evaluate the adoption of Industry 4.0 technologies in Turkey's food sector?
2. What are the biggest problems preventing the adoption of these technologies in Turkey?
3. What kind of balance do you think should be established between traditional methods and modern technologies in the food sector?
4. What advantages or disadvantages do you think the food sector in Turkey has compared to other sectors in the context of Industry 4.0?

Future Perspectives and Strategic Recommendations

- Workforce, Technology and the Future

1. How do you foresee the food sector undergoing a technological transformation in the near future?
2. What do you think about the future roles of blue and white collar workforce? Which roles will gain importance, which will disappear?
3. What strategies do you recommend to minimize or turn the effects of technology on the workforce into positive ones?
4. What steps are you taking to prepare your company for the future effects of Industry 4.0?

6.2 SWOT Analysis

Table 9. SWOT Analysis of Industry 4.0

Strengths	Weaknesses
- Increases productivity, efficiency (resource), competition (international), and income. - Provides increase in technical knowledge and high-wage jobs. - Improves customer satisfaction: provides new markets by improving product variety. - Provides production flexibility and control.	- It is highly dependent on technological change: small changes have big effects. - It is dependent on success factors including R&D, investment, suitable workforce, standards. - Implementation and development costs are high. - Risk of losing control is high. - It requires a skilled workforce and unites immigrant communities.
Opportunities	Threats
- Develops Europe's position as an international leader in manufacturing. - Creates new markets for manufacturing and services. - Prevents negative demographic distribution in the European Union.	- Concerns of cybersecurity, intellectual property, data privacy - Threat factors as workers, small and medium-sized enterprises, and regional economies - Adoption of Industry 4.0 by foreign competitors neutralizing EU initiatives

Source: (Otles & Ozyurt, 2016)

Otles and Ozyurt (2016) argue that Industry 4.0 will transform manufacturing by increasing efficiency and accelerating production processes. They predict that interactions between components, machinery, and humans will optimize production, increasing efficiency by 25% and speed by 30%. However, these projections should be critically examined through the Sociology of Expectations (SoE) framework. Although these narratives position Industry 4.0 as a necessary progression, they also help synchronize industrial and political strategies, influencing workforce expectations and rationalizing investments in automation. Focusing on efficiency and speed may overlook potential socioeconomic disruptions, including workforce displacement, skill mismatches, and rising economic inequalities. Additionally, in the research of Otles and Ozyurt (2016), the weaknesses of Industry 4.0 are shown as the increasing need

for skilled labor and the unification of immigrant communities. However, classifying this issue as a “weakness” requires further analysis, since the labor-market integration of immigrant workers depends on multiple factors, including socioeconomic conditions, policy arrangements, and access to education. Additional empirical evidence would therefore be needed to assess the actual implications of Industry 4.0 for immigrant workers.

6.3 Reviewed Policy Documents Used for Contextual Analysis

Table 10. Reviewed Policy Documents Used for Contextual Analysis

Institution	Policy Document	Main Area
Ministry of Industry and Technology	2024 Institutional Financial Status and Expectations Report	Digital transformation and industrial development
Ministry of Industry and Technology	National Technology Entrepreneurship Strategy and Action Plan	Innovation and entrepreneurship
Ministry of Industry and Technology	Return to the Future 2034 Strategy	Technological competitiveness and future development
Ministry of Industry and Technology	Food and Beverage Industry Report	Sectoral transformation and food industry development
Ministry of Industry and Technology	Strategic Plan 2024-2028	Industry 4.0 and national development priorities
Ministry of Labor and Social Security	13th Labor Assembly Report	Labor market transformation
Ministry of Labor and Social Security	İŞKUR Strategic Plan 2024-2028	Employment and workforce adaptation
Ministry of Labor and Social Security	İstihdamda 3İ	Employment and labor market policies
Ministry of Labor and Social Security	CGM E-Bulletin	Skills development and labor issues
Vocational Qualifications Authority (MYK)	National Occupational Standards and Qualifications	Skills development and workforce competencies