NATIONAL TECHNOLOGY INITIATIVE IN THE DIGITALIZATION OF THE INDUSTRY

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Abstract

With the disruptive impact of rapidly maturing digital technologies, the world has been facing a great transformation called the fourth industrial revolution. This transformation, which causes paradigm shifts in almost all fields of economic and social activity, increase the capability of humanity for producing added value, especially in the industry, to a very high level.

In the new era that started with the fourth industrial revolution, by the National Technology Initiative, Türkiye has declared its goals and vision in the competitive global environment shaped by technological breakthrough. As to digital transformation in the industry, it constitutes one of the most important components of the National Technology Initiative.

Türkiye, having a strong industrial capacity, focuses its development strategy on high value-added industrial production. In this respect, while increasing the share of high-tech products in production, Türkiye also should maximize productivity in the industry by utilizing the means of technology at the highest level. Accelerating the transformation in the industry is of great importance for the vision of National Technology, Strong Industry.

There are some probable barriers which should be handled by Türkiye in the digital transformation of the industry. The need for the guidance on how digital transformation should be addressed at the strategic level and how to manage implementation, the cost of the investments to be made and the skills gap in the execution of the transformation process are the major issues that most of the organizations would face. In Türkiye, although various public support mechanisms such as consultancy services, project-based grants and investment incentives are provided for digitalization of businesses, it is necessary to accelerate the digital transformation of the industry in order to achieve the goals of the National Technology Initiative. With this perspective, a new incentive mechanism should be introduced that will ease the identified main barriers and bring the digital maturity level of the industry to a higher level.

Keywords
National Technology Initiative, Digital Transformation, High Added Value, Digital Transformation Incentives.

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1. Introduction

The world is experiencing a period in which technological developments gained a pace as never before. It makes sense to assert that technology has become the determining factor in the production of economic and social value.

The leading powers fueling global economic growth in today's world are incremented productivity by the use of technological means and new economic value created by new products and services coming to life as a result of technological development. Today, the fastest growing and most valuable companies are technology companies or companies that incorporate technology to its business processes deeply. However, technology plays a central role not only in terms of economic growth, but also in generation of social value. Thanks to technological means, effective solutions can be created for the needs of humanity.

Although technological development has accelerated in the twenty-first century, humanity had achieved remarkable improvements in technology for decades. Very first outputs of aviation, which is seen as one of the advanced technology sectors today, could be produced more than century ago. In the 1940s, as a result of studies on physics and nuclear energy, world witnessed a real improvement in energy production which was firstly used for the well-known devastating purpose. The 1950s was the period of time when improvements in air vehicles technologies have gained a pace. In the 1960s, the world witnessed a race in the field of space and in the 1970s, the first implications of the Internet appeared. Even studies on artificial intelligence, one of the most popular and sophisticated technologies today, dates back decades. Cahit Arf, one of the most eminent scientists of the modern Türkiye's history, also carried out studies on machine learning in 1950s.

Technological developments that took place in the last century have reached to a new level in the twenty-first century. The digital technologies, such as computing technologies, data transfer and connection technologies, big data, artificial intelligence, robotics, additive manufacturing and blockchain have got mature exponentially in recent years. The rapid development in digital technologies has enabled high added value production in many areas. One of these is undoubtedly the industrial production. The intensifying use of digital technologies in the industry allows for a significant increase in productivity. It is also becoming possible to produce new products that cannot be produced with traditional tools and methods. This fact has created an important paradigm shift in the industry. This transformation identified as the fourth industrial revolution promises the potential to carry the added value production to a much higher level in all fields of economic activity.

2. Effect Of Digitalization in The Industry

One of the determining factors of high added value in industrial production is the technology intensity of the manufactured product. If the final product is developed as a result of R&D activities and produced with technology-intensive processes and methods, it generally promises higher added value. In this respect, increasing the share of high-tech products in industrial production constitutes one of the priority strategies in development. Besides, there is another effective way to increase the added value in the industry, regardless of the end product's technology level. The digital transformation achieved by the use of fourth industrial revolution technologies offers huge potential of economic value.

Digital transformation in the industry comprises much more than increasing efficiency by making use of some digital technologies in production processes. Reducing the waste of resources in operational processes, automation of repetitive work and producing more

output with less input could be mentioned as the benefits of digitalization in the first place. In fact, far beyond this, digital transformation provides leverage for added value in many other dimensions such as workforce efficiency, quality management, supply/demand management, market access and after-sales services (Fremont, 2021).

Factors such as automation, connectivity and digital data that drive digitalization in the industry pave the way for new propositions in the industry. With autonomous vehicles, interactive robots and drones which are fueled by robotic technologies, highly efficient and error-free production becomes possible. Smart factories and digital products are the flourishing concepts that are aroused through cloud computing and broadband communication. The use of big data produced by IoT and wearable technologies brings along perfection in demand forecasting, maintenance planning and quality management (Roland Berger, 2015).

3. Digitalization In Turkish Industry

As an exporter country facing fierce competition at global markets, Türkiye always has to keep its competitive position by increasing the productivity of its industry. Because of this necessity, Turkish industry has been following the developments in production technologies closely and putting remarkable effort not to miss the fourth industrial revolution. However, as the world gears up in digital transformation, Türkiye needs to accelerate its digitalization of industry in order to gain much more weigth in global economy.

As for all countries, including developed ones, there are some challenges for achieving the digital transformation for Türkiye. A study conducted by a well-known consultancy firm to determine the digital transformation readiness level of the Turkish industry shows the prominent challenges for Turkish companies (McKinsey, 2018). According to the report, the greatest barrier for industry is about understanding the digital transformation and putting forward a clear vision and strategy in this context. In addition, the lack of expertise to plan and manage this transformation and the lack of sufficient knowledge of new technologies and means are seen as important drawbacks for companies. Moreover, one of the most apparent barriers is the financing of investments. It is obvious that the use of fourth industrial revolution technologies and digital transformation is not a cheap investment at all (Albukhitan, 2020).

4. Acceleration Of Digital Transformation In The Industry

4.1. Strategic Targets and Roadmap

For Türkiye, adopting a development model based on value-added production, digital transformation in the industry constitutes the most important part of its development vision. In parallel, one of the five main components adopted in the 2023 Industry and Technology Strategy, which stands as the concrete action plan of the National Technology Initiative, is devoted to digital transformation (Ministry of Industry and Technology, 2022).

The technological development is creating disruption in many economic and social fields. This transformative effect brings along the opportunities and threats for countries. National Technology Initiative specifically focuses on making the most of these emerging opportunities. In this respect, dedicated strategies and action plans are being prepared regarding the focus areas determined in the Industry and Technology Strategy. One of these, prepared by the Ministry of Industry and Technology, is the Roadmap for Digital Transformation of the Industry. The Roadmap is about to be ready for publication officially.

4.2. Digital Transformation Knowhow

Digital transformation should be handled with a holistic approach that aims to transform business processes, ways of doing business, corporate culture and even the product itself. Therefore, it requires some certain competences in order to have successful results.

It's not easy for an organization to build necessary capacity to manage digital transformation in itself. Mostly, external expertise is required to determine the current digital maturity of the enterprise, to identify possible improvement opportunities, to create a roadmap addressing these areas and to choose the ideal technology solutions for the goals set in the roadmap.

In Türkiye, various steps have been taken to provide guidance for digital transformation to the industrial sector. Under the leadership of the Ministry of Industry and Technology, important public initiatives have been implemented in order to meet the need for guidance of companies. Turkish Management Sciences Institute (TUSSIDE) of TÜBİTAK provides remarkable contributions to the studies in this field. With the digital transformation maturity model developed in cooperation with the academy, TÜSSIDE has created a practical framework for the analysis of the current readiness level of the industry and proposing roadmaps for companies. In this context, TUSSIDE has started to train digital transformation experts to provide companies guidance that they will need during the transformation process.

In order to provide companies with easy access to practical training and guidance on lean production and digitalization, Model Factories, established by the Ministry of Industry and Technology in important industrial centers of Türkiye, are becoming centers of excellence for productivity and digital transformation. As of first half of 2022, Model Factories started operation in eight cities, namely Ankara, Bursa, Gaziantep, İzmir, Kayseri, Konya, Mersin and Adana. In addition, it was announced by the Ministry that seven more Model Factories are under construction in Denizli, Eskişehir, Kocaeli, Malatya, Samsun, Tekirdağ and Trabzon (Ministry of Industry and Technology, 2022). Model Factories, with their increasing numbers, will become the main mechanism that guides the digital transformation of the Turkish industry.

Benefiting from international experience and knowledge in digital transformation is considered important both in terms of public policies and in terms of implementation at company level. The adoption of best practices set forth in other countries would contribute to rapid results in digital transformation. With this perspective, an accredited outlet of the Centre for the Fourth Industrial Revolution Network of the World Economic Forum has been brought to Türkiye. MEXT, the world's largest model factory and technology center established by MESS, has been designated as the WEF Centre for the Fourth Industrial Revolution by the Ministry of Industry and Technology. The center is focusing on creating knowledge and recommendations to be considered in policy making processes and initiating pilot projects by benefiting from collective know-how of the WEF network.

4.3. Supporting Digital Transformation Investments

In industry where profitability margins are not very high, it is not easy to decide to invest in Forth Industrial Revolution technologies since this investment could be costly. For companies who do not have sufficient knowledge and awareness about the potential impact of digital transformation on business efficiency and profitability, this becomes an important barrier. To accelerate the digital transformation in the industry, it is undoubtedly a

necessity to take encouraging measures to reduce the investment costs of companies. In an area where there are already cultural and skill barriers, it is critical to ease the financial concerns.

Many developed economies, particularly European Union, show aggressive approaches in this regard. The European Union has predicted that there will be an investment need of 125 billion Euros each year until 2030 and has put forward strategies to make this investment happened (EU for Digital, 2022). Italy, an important industrial country, has allocated a budget of 24 billion Euros for the period 2020-2022 to support digital transformation investments under the Industry 4.0 Program (Ministry of Economic Development of Italy, 2022).

In Türkiye, there are significant supports and incentives for the digital transformation of the industry. The Investment Incentives mechanism is the one that has the largest impact. Within the scope of the "modernization" incentives in this mechanism implemented with the "Presidential Decree on Granting State Incentives for Investments", tax credits from corporate and employment taxes are offered for digital transformation expenditure. With this incentive system, thousands of businesses benefit from government support for their investments in digitalization every year.

In addition, KOSGEB provides grants and financial support to the digital transformation processes carried out by SMEs on a project basis. Under SME Development Support Program, both companies that develop digital transformation solutions and that use these solutions to transform their businesses can benefit from these supports. In 2021, approximately 460 SMEs received digital transformation support. Apart from this, under Business Development Support, approximately twenty thousand SMEs were given grants for expenses such as testing and technical consultancy (KOSGEB, 2022).

5. Proposing A Model to Accelerate Digital Transformation

The study on the digital transformation readiness level of the industry in Türkiye which was mentioned before, four main barriers were determined for regarding the transformation of industrial companies. The first of these barriers is concerns about the cost and return on investment. Companies see digital transformation investments as costly and they think that they may not get the return of this investment in a short time. Given this finding, it would be impactful to bolden the offers of current incentive mechanisms to convince investors in terms of economic return on investment. Another important finding of the research is that companies need guidance on how to manage digital transformation. Companies often fail to reveal a clear vision and strategy in this regard. In a digital transformation without a determined vision and strategy, it is unlikely to get intended benefit from it. In order not to fall this trap, it might become vital for companies to receive guidance from an external party.

The third most critical barrier for the digital transformation in the industry is the skill gap in the organization. Digital transformation requires a pool of competences to apply new technologies in the enterprise and skill set to use these applications. Closing the skill gap of existing personnel and employing new talents that will contribute to digital transformation is a real challenge for companies. It is of great importance to support industrial enterprises in this regard. The fourth main finding is about the suppliers that will contribute to the digital transformation. For industrial enterprises, the need for working with the right suppliers comes to the forefront in a challenging transformation process. Companies need to know about competent and cost-effective solutions in the market and receive sustainable

support from the supplier along the lifetime of product or service. Therefore, there should be a well-developed, reliable, domestic digital transformation supplier ecosystem.

Considering the main needs of companies for a successful transformation, a holistic approach was developed for upgrading the incentive mechanisms aiming digital transformation in the industry. With this new perspective, digital transformation is considered as a continuous development journey for businesses which could be conducted within three-years long life cycles. Each cycle would consist of digital maturity assessment, the creation of a transformation strategy and roadmap, identification of the projects to be carried out and the digital technologies to be applied according to the roadmap, the investment phase and finally, the impact analysis of each cycle.

In the first phase of the new incentive model which was designed according to the new approach, the DDX model developed by TÜSSIDE is to be implemented for assessment of digital maturity of candidate companies for transformation. The accredited digital transformation experts would assess the readiness level of the companies and by considering all the competencies and business strategies of the company, a company-specific transformation roadmap is to be proposed by the experts. This roadmap would constitute the customized framework for incentives that the company will benefit from.

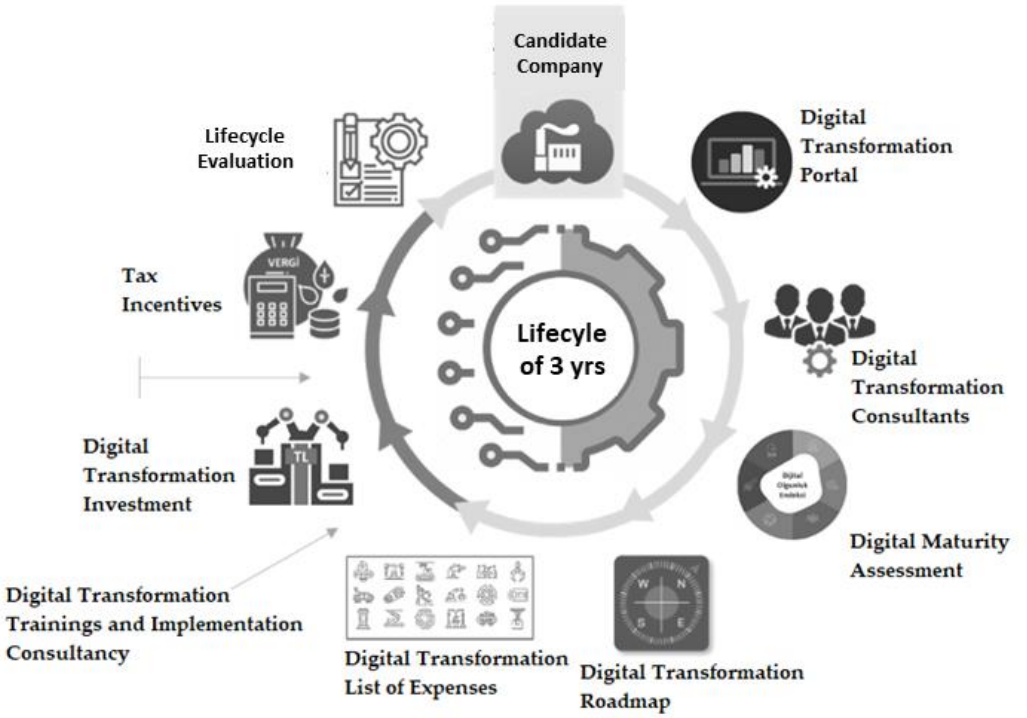

Figure 1. *Proposed Digital Transformation Model Lifecycle*

After the first phase where the roadmap that the company will follow during the three-years long life cycle, the implementation and investment process begins for the company. Digital transformation expenses of the company throughout the cycle are to be supported within a special incentive system. This new mechanism is designed as a combination of two similar incentive systems currently being implemented, which are R&D incentives and investment incentives. Both systems have been applied consistently for many years in Türkiye and have

created a widespread impact. Best practices form both mechanisms are adopted in the new incentive scheme to achieve an overall uptake in digitalization of industry. With this perspective, the new incentive model is designed in a way that a wide range of businesses can benefit from by simplifying the application, evaluation and auditing procedures. Companies would get tax credit for digitalization investments which are compatible with a pre-determined list of expenditures at rates differentiated according to strategic importance of expenditures. Additional incentives are to be provided for solutions procured from domestic technology ecosystem. Incentive mechanism basically relies on a self-declaration method. It will be conducted through the digital transformation portal where all the applications and the declarations are submitted. By the mean of this portal, digital maturity status of the companies would be mapped, the improvement in overall digitalization of industry would be monitored and public policies regarding digital transformation in the country will be optimized accordingly.

6. Conclusion

National Technology Initiative is the vision of building a competitive and leading economy on a global scale by achieving the technological breakthrough and increasing high value-added production in Türkiye. Considering its widespread impacts, digital transformation in the industry is one of the critical priorities of the National Technology Initiative.

Türkiye's digital maturity level is not at the desired level yet. Considering the rapid developments in the global competitive environment and the aggressive investments of other countries, the speed of digital transformation in Türkiye needs to be brought to a much higher level. Currently, significant steps are being taken in Türkiye in line with this aim and the private sector is incentivized by the public through different methods and tools.

Türkiye, which has declared the vision of the National Technology Initiative, is dedicated to be one of the leading countries in the global scene in terms of the digitalization of the industry. In order to achieve this, the private sector has to be mobilized to transform their businesses by providing guidance and sufficient support. To create a country-wide impact, it would be very beneficial to introduce a dedicated incentive mechanism for digital transformation with a holistic approach addressing the needs of the companies in this challenging journey.

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Zekeriya Costu has been serving as the Director General for National Technology in the Ministry of Industry and Technology since August 2020. Prior to his current position, he had been in charge of execution of the the National Technology Initiative in The Ministry of Industry and Technology as the Director of Project Management Office. During this time, he took part in a variety of programs and projects that have had significant impacts on the national technology ecosystem. Costu has also an extensive experience in aviation and broadcasting industries. As the DG for National Technology in MoIT, Costu is holding a critical position which is responsible for facilitating the technological improvement in Türkiye in various dimensions from R&D activities to entrepreneurship.