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**Project Title: Development of an executive roadmap for digital grid transformation (digital transformation of the electric power industry)**

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### Keywords:

Ecosystem, Digital transformation, Electric power industry, Roadmap

### Project Necessity:

Nowadays, digital technologies have become an essential part of our life, society, and economy. The fast advancement of digital technologies and the emergence of new technologies like Cloud Computing, Artificial Intelligence, Robotics, Internet of Things, Mobile Computing, and Big Data, have contributed to new opportunities in different industries to increase efficiency, effectiveness, and profitability. These new technologies have led to massive transformation in the world which is now called digital transformation. In recent years, the digitalization of active businesses is of vital importance in any industry or geography, hence, there is no other way to protect traditional businesses and management approaches. Different surveys and statistics show that many industries have started their digital transformation, so the electric power industry should not remain an exception. In other words: "Digital transformation is no longer a choice for the electric power industry, it is a great responsibility towards our society and industry".

Regarding the extent and the penetration rate of digital technologies in the electric power industry, the government should adopt and implement new programs and novel approaches to utilize digital technologies in order to solve the challenges and inadequacies of the electric power industry. Every transformation requires an effective strategy and a successful management approach, therefore, the first step towards digital transformation is developing a digital transformation roadmap in a fixed time horizon with long-and short-term goals and objectives. For these reasons, the project titled 'Development of Digital Transformation Roadmap of the Electric Power Industry' is defined in the Digital Transformation Center of Niroo Research Institute.

### Project Goals:

The top-level goals are:

- Identification of problematic issues in the electric power industry which can be alleviated through digital transformation.
- Identification of future electric power industry's opportunities and the effects of digital grid transformation in the realization of them
- Study and analysis of the current digital transformation ecosystem in the electric power industry.
- Definition of coordinating pillars of digital transformation in the electric power industry.
- Design and development of the digital transformation roadmap in the electric power industry.

### **Abstract:**

The main approach of the digital transformation roadmap is to solve or alleviate the major issues of the electric power industry. Based on extensive research and experts opinions, the main issues of the electric power industry are defined and divided into four categories: economic issues, low efficiency, low reliability, and high energy intensity. These known issues and challenges have had severe consequences during many years, such as budget deficit of the Ministry of energy, different stakeholders' dissatisfaction, delay in program achievements, damages to the power grid and environment, and national and environmental costs. As research demonstrates, other countries have deployed different programs and approaches to solve these problems, which are listed below:

- Decentralization and transferring authority and responsibility from the central government to quasi-independent government organizations and/or the private sector.
- Invention of a novel cohesive ecosystem and development of new business models.
- Realization of Sustainable development goals (decarbonization, better efficiency, and low energy consumption)
- Electrification (transport, heating system, and industrial processes)

These four key goals are introduced as the main digital transforming factors for the electric power industry. Based on international research, the best way to realize these goals is to employ new transformative digital technologies within the digital transformation framework. So, the use cases of digital transformation should be first identified in order to find the future opportunities. The applications of new digital technologies in the electric power industry are called digital use cases which are classified into three themes: digital customers, digital organization, and digital assets. The digital organization includes the new digital technologies used to create value from aggregated data, define new business models, and improve processes and employer's safety. On the level of digital network and assets, asset management and operation optimization are crucial to efficiency improvement and cost reduction. On the level of customers, the introduction of new services and products and providing interactive communication are very important.

Next in the project, the key stakeholders and players have been identified and the digital transformation ecosystem is proposed. This ecosystem can be considered as part of the innovative ecosystem of the Ministry of Energy. Finally, the roles and responsibilities of different players and stakeholders are determined based on the chosen methodology.

Coordinating pillars of the digital electric power industry are defined as vision, goals, objectives, strategies, policies, and projects. These pillars are considered in three layers of enabler, application, and impact. The enabler layer has five constructs, namely regulation, infrastructure, security, literacy, and open data. The application layer consists of digital organization, digital assets, and digital customers. In the impact layer, the effects of four key issues (economic issues, low efficiency, low reliability, and high energy intensity) are

considered and assorted in political/social, technical, economic, and environmental classifications. To realize the objectives of each layer, a group of strategies, policies, and programs/projects in the time horizon of 1404 are defined. In the application layer, 6 strategies and 10 policies, and in the enabler layer, 5 strategies and 9 policies are determined. Furthermore, the digital electric power industry strategies are mapped to the key issues. The programs and projects are also prioritized based on electricity generation, transmission, and distribution. In the next step, the subset projects and their rough estimated schedule and budget are determined. Finally, an executive guide for monitoring and controlling the progress and accuracy of the roadmap based on the devised KPIs and main goals is proposed.

### **Steps and Methodologies:**

The methodology of the digital grid transformation roadmap consists of four phases: ‘identification of key issues and opportunities and determining the effects of digital transformation on them’, ‘study and analysis of current digital transformation ecosystem in the power industry’, ‘Identification of the four coordinating pillars of digital transformation’, and ‘development of the final roadmap’. The goal of the first phase is the identification of key issues and opportunities and their prioritization. That is, the first step of the roadmap is dedicated to the identification of the main strategic issues. In the second phase, the important factors of the ecosystem are identified and analyzed, then the best ecosystem model is proposed. In the third phase, the vision, goals, objectives, strategies, and policies of digital transformation are examined based on social, cultural, economic, and environmental aspects. Finally, in phase four, the projects are defined and prioritized and their schedule and budget are roughly estimated. The executive guide and mechanism and related national plans are also determined to implement the digital roadmap based on the defined KPIs.

### **Main Results (technical outputs, patents, papers, books, reports, etc.):**

- Development of the programs, national plans, and the executive digital roadmap of the electric power industry.
- Several technical documents for each phase of the project.
- Five published papers based on the results of the project.