Industry 4.0 a strategic adaption view; implementation model in an Albanian company

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Abstract: *With time going by, industries have revolutionized, and continuous upgrade has taken place to strengthen its functionality of resources sharing and integration capabilities of functional units. The article aims to identify and suggest industrial models with the country's potential in adapting Industry 4.0, and conceptual implementation in an Albanian company. The work clears the overall picture of Industry 4.0 in a country with modest adaptation potential, where technologies adapt to the country's current needs. The study is based in an analysis of the most important indexes to understand the overall approach of adaptation. All the concepts and analysis are finalized with the Industry 4.0 principle and implementation in the Sideral company. The methods presented offer some good proposals for further implementation policies in industrial companies.*

Keywords*: INDUSTRY 4.0, INDUSTRY 4.0 INDEXES, INTELLIGENT WAREHOUSE, BASIC TECHNOLOGY, CHAIN OF GLOBAL VALUE.*

1. Introduction

Industry 4.0 or the Fourth Industrial Revolution can be defined as the concept of an integration between Information and the Digital Revolution [1]. The term is the generation of three previous revolutions, with a particular focus on increased productivity and efficiency. The primary idea has been presented in Hanover's 2011 Congress, treated as a strategic program to develop advanced production systems [2]. Among other things, this new phase of the industry requires a socio-technical evolution of human role in all business ecosystem modules. The Industry 4.0 brings the concept of automation far ahead. It creates a full digitalization and a transformed automation process, in all its constituent stages, concluding in an "intelligent factor". Exploring Industry 4.0, may help to resolve high uncertainties and gain more competitive advantages. Technology architecture [3] of the Industry 4.0 has a huge potential to reshape the way companies operate. Based on their main objective, we have two technological divisions:

1. Front technology, which considers four dimensions (intelligent production, intelligent product, intelligent supply chain and intelligent work). The central dimension considered intelligent production, while other dimensions are related to it. Each dimension adapts to other sub technologies creates added value.

2. Basic technology, which supports the other intelligent dimensions discussed above. Such technology includes: Internet of Things (IoT), Big Data, Cloud Services, Robotics, Artificial Intelligence (AI), Analytics, Additive Production, Digital Twins, Added Reality, 3D Printers. These technologies are considered basic, as influential integration dimensions are present in them.

In order to evaluate the potential of Albania in adapting Industry 4.0, there are used nine indexes round up analytical treatment. Index analysis is widely acknowledged to play a vital role in the opportunities of the countries to adapt Industry 4.0. The process of technological standardization within the business ecosystem is identified as the backbone of Industry 4.0. Index results unfold value benefits in further implementation directions.

The main purpose of this study is to conduct a systematic literature review, to explore the breadth and depth of existing industry readiness for Albania and then to present a real implementation model based in Industry 4.0.

2. Methodology

The article follows an empirical course of treatment. Methodology is based on research questions, literature review, and also on available data to analyze. To successfully master the research work, the concentration on the following steps help us:

1. The first phase is the selection of the field of research and the assessment of contextual knowledge through scientific research, articles, books, etc.
2. Phase two, analyses the indices that best identify the Industry 4.0 potential. The data is collected by open sources, while the results released are presented in practical form, as applicable solutions to Albanian companies' case.
3. The third methodological phase is based on deductive research for building an implementation model, which highlights the role of the Industry 4.0 throughout the business area.

This study empirically tests the relationship of new technologies and business modules through the use of Industry 4.0, based on index analysis. Business executives will find this article informative as they contemplate whether to invest in and outsource to other countries. In addition, policymakers will learn about the challenges and opportunities of Industry 4.0 adaption in Albania.

3. Industry 4.0 adaptation

Analyzing Industry 4.0 adaption using index techniques, would be a necessity for decision support. These indexes are easily found. Index analysis best covers strategic framework of technologies. Consistent with the rich research around general development, efforts to improve, and valuable detective data, Albania can be classified as one of the least industrialized countries. The power of analyze, refers to the performance of Albania, in accordance with Industry 4.0. In studying the nine indexes that best identify Industry 4.0, last results obtained by "International Research Institutions" will helps us in this work. In this purview, the treatment of indices is presented as follows:

The global Innovation Index (GII) [4]. Allows us to analyze the potential, based on two main components: innovation and production of innovation. Referring to the total assessment (1-100), the GII annual total value for Albania is 27.12. In Albania braiding elements such as: institutions, human capital and research, infrastructure, market sophistication and business presents a modest increase in reference to total assessment. Although the global science and innovation landscape has undergone significant changes, Albania is involved in an innovative dynamic of national influence.

The Logistics Performance Index (LPI) [5]. Logistic operation is included in the framework of regulatory services, securing transport infrastructure, enforcement of audits (particularly for international goods) and boosting the quality of Public-Private Partnership. In its assessment of 1-5 Albania receives its annual rating of 2.62. Hence, weighing elements such as: customs, infrastructure, international shipments, logistical quality, tracking and deadlines guarantee Albania a more generalized view. Improving infrastructure to promote trade among the countries has narrowed the gap in terms of institutional governance problems, or other logistical-type threats.

The Global Enterprise Index (GEI) [6]. The focus of Industry 4.0 on production alone does not generate the total view. The Enterprise

Index, help our treatment approach for a deeper focus. Entrepreneurship in our country can be measured at levels such as: entrepreneurial attitudes, entrepreneurial skills and entrepreneurial aspirations. Integration of such levels concludes at a low level of entrepreneurship (based on the latest annual assessment 22.5), though recent years the health of the entrepreneur's ecosystem is on a steady rise.

Human Development Index (HDI) [7]. Demonstrates the country's human development status through components such as: life expectancy at birth, expected years of schooling, average years of schooling and gross national income per capital. Our country, relating to the statement on the overall score of 0.791 at the range of 0-1, is represented by governance at acceptable stability rates, average health access, development not in emphasized dimensions of unification and education on average levels. The index represents strategic importance in adapting Industry 4.0, because human capital can assist massively, or completely prevent implementation of Industry 4.0.

Environmental Performance Index (EPI) [8]. Reflects the vitality of the ecosystem, and serves as an instrument in adopting Industry 4.0. Based on the overall assessment, Albania reflects an average score (49 from the range 0-100). It relies on environmental policies with average efficiency. Consolidating this item can significantly increase total environmental performance. The Industry 4.0 helps heavily on improving such an element.

Industrial Production Index (IPI) [9]. It identifies common quantitative and qualitative progress in volume of the Gross Domestic Production part. Based on its industrial production and indicators, we study the country's current potential. Progress towards Industry 4.0, among others, requires a constant and adequate production environment. In monthly terms Albania presents a significant decline in industrial production, (-22) justified by the pandemic situation.

Industrial Competitiveness Index (CIP) [10]. Reflects the role of subfactors such as: the capacity to produce and export produced goods, technological deepening and global impact. At a range of 0-1, Albania is estimated at 0.008, which means significant restrictions on industrial management, and policies at modest levels of adaptability.

Structure and drivers of production [11]. Both factors are part of "readiness factor", which represents strategic importance in implementation. Therefore, to successfully master Industry 4.0 readiness, calculation of upper factors presents strategic importance. Interestingly, there has been a quick escalation in the number of Industry 4.0.0 readiness models in the recent few years. However, it has also been discovered that a large number of academic Industry 4.0.0 readiness models are not known in Albania industry, as they are less pragmatic in terms of fast-moving objectives of industry.

Analytical results

The proposed analysis describes the capability of Albania in adapting Industry 4.0. The adaption was affected by external and internal factors. The acquired results unfold how governments can address issues related to Industry 4.0. In addition, international trade, partnership with high-tech companies, and advancement in technical schools would represent adequate intensification for a digitalised ecosystem approach. Dealing with Industry 4.0 as a socio-technological challenge attaches particular importance to the holistic integration of production and society. In that context, the needs for change in Albania consists on: the propriate basis of knowledge on the operating market-operation between research-development institutions and focus on obstacles. While further adaptation opportunities refer to: capacity in internal dimensions, influence of political instruments, obtaining a resilient environment towards changes and awareness at a trade level.

4. Industry 4.0 adaptation in Sideral Company

Implementation of Industry 4.0 is designed based on strategic and important steps. In that context, supply chain and physical logistics, are aspects that undergo greater metamorphization in the entire implementation framework.

Step 1: Readiness factor calculation

Readiness factor is in most cases defined as a stage between four industrial revolutions [14]. This can be understood even as the decision-making process because management has to decide whether their company is ready for the complete automatization or not. In general, are known two calculating methods:

External method

Internal method

External method [15] allows us to calculate the readiness factor according to a national adaption. Analysis in Albania has been made regarding in the criteria of communication level and automation in sector of product development, technology, logistics, quality control, PLM and others. In most cases readiness factor according this method, consists of two elements: structure of production and drivers of production. On the other hand, structure of production consists of two other dimensions: complexity (is used to analyse how country's different types of knowledge and technology are combined with each other in the manufacturing sector) and scale (Manufacturing Value Added). According to "World Economic Forum", Albania presents following results:

Complexity=3.9

Scale (manufacturing value added) =1

Total structure of production referred to the weight of above elements results:

Structure of production=complexity (60%×3.9) +scale (40%×1) =2.74

Similarly, we act for drivers of production. The result of its six constituent factors, is provided:

Technology and innovation=3.4×20%=0.68

Human capital=4.6×20%=0.92

Global trade and investments=3.7×20% = 0.74

Institutional frame=4.7×20%=0.94

Steady production=6.2×15%=0.93

Request environment=3.2×5%=0.16

Drivers of production=0.68+0.92+0.74+0.94+0.93+0.16=4.07.

As we see the drivers of production score is higher than the structure of production score [16]. That let us understand that technological aspect (and its components) affects mostly the total readiness. The country's readiness in this approach does not reflect optimism of implementation.

On the other hand, internal method [17] calculate readiness factor, using another scenario. The high importance in this method has the integration of hardware, software, human and organisational capital within the company. This method, helps us determine the digitalisation level within the company. In this point of view, internal audits and the use of the DSS could increase value. Based on Sideral company, general and technical questions help determine the level of technological development. The company has successfully adopted basic technology's in order to provide high-quality products, service in contemporary standards, proper conditions for the employee, and provide a more protected ecosystem. Partial lack of digitalisation does not create insurmountable barriers. Through evaluative alternatives:

ready with minor modifications

ready with medium modifications

ready with major modifications

not ready – drastic modification required

not ready – no benefits of Industry 4.0 in the future

and based on modelling reasons, we can operate with "ready with major modifications" [18] alternative.

Step 2: Business field planning

Major changes are required for Sideral company so it could adjust to the concepts of Industry 4.0. Based on the final purpose-digitalization of business modules, below we present the implementation objectives:

High flexibility. It provides for the company rapid response and operating pace, approving innovative digitalised distribution.

Precision. Through solid, accurate and real-time data, we provide the right decision at different indicator levels.

Efficiency. It is provided by the automation of physical tasks, the process planning, control and exchange of information. Technology adapts to the product offered in the market.

Focused on segment techniques, mass personalisation, specific advancement practices, will help Sideral company provide solution packages in all modules. However, meeting such goals faces challenges as follows:

Lack of management support

Financial constraints

Unwanted changes

Lack of proper expertise

Legal restrictions

Lack of policies and government supporters

Based on objectives and challenges mentioned, lets address more detailed steps.

Step 3: Prototype development

The benefits of basic technologies [19] integration can appear within a considerable time range. Our implementation effects three main directions as follows:

Fig. 1: *Influential directions of Industry 4.0*

This step consists of modelling a basic prototype to gradually assess needs, changes and benefits. The Sideral company deals with trading construction materials, and referring to the upper plan of implementation, intervention in warehouse would be ideal to present modest changes. In addition, other modules such as: finance, the sale, etc. are presented in a simpler framework than the warehouse directly related to work, persons and the work environment. The prototype is presented modest both in financial and operative terms. To reduce the most emphasized problems in the top three dimensions, our prototype affects two directions:

1. Voice-picking [20] technology. The voice-led warehouse uses recognition of the word to direct employees where to go and how to find stored materials. The primary goal of selecting this model under the prototype is to help warehouse operations in redefining and modernization of the ordering processes and significantly lower operational costs. For the very nature of products traded voice-picking is thought to be optimal choice, which is well integrated into further implementation software.

2. Sensors presence on product lines. The contribution of sensors in obtaining the IoT within the company is really huge. They also help identify overall physical logistics, in the added chain of value, etc.

At such an experimental phase, human capital training receives strategic importance. The prototype can result successfully and achieve positive results, if employees are better skilled and integrate with all dimensions. This way increases significantly the role of human capital and its adaptation to the environment or work within the business ecosystem.

Step 4: Prototype evaluation

In this step prototypes considered above, are subject to specific analysis and evaluations. Estimates are examined at the moment when changes in total ecosystem performance are noticed. This step is worth showing how much we would benefit from the proposed models. Hence, following estimates are based on adequate ability and treatment of human capital.

Voice-picking, present a technology in which each operator equipped with a voice selection device (earbuds, mobile-equipment, barcode scenario), takes the order and tasks it must perform. Such equipment also includes multi-model reactions, so the operator's voice returns the information again. The coordination and performance obtained is quite high. Among other benefits mention:

1. Increased accuracy. Using voice-picking actions such as: scanning barcode, filling paper documentation or oppression in a computer system are eliminated. The coordination within the warehouse increases by 85% accuracy.

2. Increased productivity by 35%.

3. Faster training. Through this simple and practical solution, store operators not have to learn complicated documentation, active data or procedures, but sufficient focus on an innovative technology

4. Secure storage.

On the other hand, sensors help control the conditions and functioning of trading materials. This helps increased productivity managers and minimize repair costs. They provide:

a. Free information and high powers of processing data.

b. Transformation of traditional inventory management.

c. Comprehensive maximization of quality in work.

d. High efficiency in helping reduce the job, and quality control costs.

The success of this step creates real opportunities for integration between prototype and other technologies of Industry 4.0.

Step 5: Prototype replication

Human capital training it's realized in both upper steps. Hence, in the following steps, the adaptation of technologies is facilitated. The changes that follow this phase have a substantial effect on traditional roles within the organization and better integrate existing technologies.

Constant pressure on the increasing number of orders, and fast processing identifies the need for a successful form of management. Warehouse Execution System (WES) [21], aims to address and improve such aspects of the company:

1. Improvement in human decision.

2. Real-time execution of customer orders.

3. High productivity by 15-30%.
4. Access to transportation difficulties.

WES transformed into an essential part for IoT operation and creates major facilities in adopting other automatic technologies. Construction materials traded in Sideral companies are problematic for employees who have direct contacts with them (form, size, weightiness). To avoid such problems, it comes to us Automated Guided Vehicle (AGV) [22] technology. Such technology provides important benefits:

1. High security of employees and structures.
2. Modest work costs.
3. Increased accuracy and productivity.
4. Simplification of inventory and ordering processes.

Integration of basic technologies and internal business modules, provides significant improvement and sophistication. In addition, integration platform best reflects Industry 4.0 model.

Fig. 2*: Integration platform of Industry 4.0*

Step 6: Total spread

The above steps have generated "smart warehouse" and IoT adaptation for the Sideral company. The focus in this phase is on the technologies they have direct connection to data received through IoT. The value chain is an attractive element for digitalization. The correct coordinating of all managerial levels influences the entire performance of the company; therefore, the integration of models is essential. Automation of all departments of the organization, including accounting, customer relationship management, inventory management, can done through Cloud ERP [23] software. The movement of products and inventory is mainly followed by WES. On the other hand, ERP uses this data generated by WES to integrate other modules that are in the company. Cloud presents facilities in strategic and managerial directions, offering accessible solutions at all levels. The Software as a Service platform, used for the implementation of ERP, creates new opportunities for e-commerce. E-commerce is a necessity in trading companies referred the implementation of the Industry 4.0. The purchase is based on the need that affects the last line of business, so the functioning of e-commerce ERP helps not only in the total management of the e-shop, but also in the digitalization of the value chain. The last step also coincides with the fulfilment of the final goal of implementation of Industry 4.0 in the Sideral company.

.5. Conclusions

This study enabled us to recognize Industry 4.0 in another dimension. The immediate possibility of adaptation of industrialized countries has always reflected images, which create numerous adaptation barriers for other countries. Started from the generic meaning of Industry 4.0, we have tried to adapt Industry 4.0 to a less industrialized country like Albania. Through analyzing the potential and country adaptation, we devise improvement opportunities and concrete plans, which are valid for different operating areas. Trade is one of the activities that better identifies business in Albania, therefore the presenting of Industry 4.0 in such direction would more clearly express its basic meaning and purpose. The adaptation of basic technologies according to the real needs of the company enables growth and gradual implementation development. Implementation method used, has been integrated and the influence dimensions of Industry 4.0. After sometimes it will replace and substitute the way of the traditional practices of manufacturing and trading. Basic technologies in each implementation step integrate with elements of the business for a comprehensive digitalization.

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