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SMART SPECIALISATION AND CLUSTER POLICIES FOR DEVELOPING INNOVATIVE CAPACITIES AT REGIONAL LEVEL

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Abstract: *The present paper deals with the concept of fourth industrial revolution, called Industry 4.0, which allows the achievement of smart, efficient, effective, individualized and customized production solutions at reasonable cost, in the wider context of smart specialisation orientation of industrial clusters defined by European public policies. The associated case study of the regional clusters environment in Romania, spurring from the S3 initiative, refers to the opportunity to refurbish an old industrial platform from North-East region of Romania, focused on the proposal of reconstruction and development of an Industrial Holding, as a private initiative of creating an innovative regional cluster, covering a Smart Specialisation priority in the North-East Region of Romania, and assuming the Industry 4.0 concept as its only way to be competitive in the actual global and "aggressive" specialised markets. The results of our study confirm the importance of the niche market of Hydraulic Power Tools 700-4000 bar and miniBOOSTER solutions in the North-East region of Romania, as an important resource for employment and supporting the development of a horizontal industry, including many innovative start-ups, i.e. Start-up of the Joint Company, Fortus Corporation - Industry 4.0.*

Key words: *Smart Specialisation, Regional Clusters, Industry 4.0, Industrial Holding Fortus Corporation.*

1. INTRODUCTION

1.1 Smart specialisation

Smart Specialisation approach has developed new modalities of discussing about local / regional development and structural change, contributing to the EU regional policy formulation. Essentially, the concept of Smart Specialisation addresses the issue of specialisation in R&D and innovation and provides a basis for designing effective strategies for the medium-long term development of European regions [1]. Thus, Smart Specialisation is designed to support regions / countries for identification of the most promising and possibly effective areas of specialisation, and to encourage investment, destined to complement the local productive and knowledge assets, in order to create future comparative advantages.

The adoption of Research and Innovation Smart Specialisation Strategies (RIS3) is comprised in the Europe 2020's Innovation

Union flagship initiative and the EU Cohesion policy, as part of the strategy to deliver smart, sustainable and inclusive growth [1].

1.2 Cluster policies

The European Cluster Observatory set up by DG-GROW aims at strengthening the role of cluster policies in order to support the EU industry, by monitoring works related to the concept of emerging industries. Although there is no consensus yet on the definition of emerging industries, the European Cluster Observatory adopted the following definition: "*emerging industries*" are linked to the creation of new industrial value chains or the radical reconfiguration of the existing ones [1]. New configurations will be often driven by a disruptive idea, leading to the development of new products/services with higher added value.

Thus, emerging industries can be identified either as new industrial sectors or as parts of existing ones that are evolving or converging towards new industries. As previously defined,

the concept relates to the idea of configuration change that is central in the Smart Specialisation approach. This is very often driven by human necessities, key enabling technologies, new business models and the societal challenges, by triggering or pushing the industrial transformation.

1.3 Industry 4.0

The Industry 4.0 paradigm relies to the connection of physical items such as sensors, devices and enterprise assets, both to each other and to the Internet [2]. It implies the existence of a modern, interdisciplinary model for product development, corresponding to a common, integrated and interdisciplinary method, referring to processes and IT solutions [3]. In this respect, the production process is divided into small value oriented units, which share information that leads to an increased flexibility and reduction of coordination complexity [4]. So, Industry 4.0 targets to convert the regular machines into self-aware and self-learning ones, in order to improve their overall performance and maintenance management, and the construction of an open, smart manufacturing platform, for industrial-networked information applications.

2. RESEARCH OBJECTIVES

2.1 Issues and Challenges in Industry 4.0

The discovery of new technologies determined the industry development, from the early adoption of mechanical systems, till today's highly automated assembly lines, to be responsive and adaptive to current dynamic market requirements and demands. Challenges like embodiment, predictability, flexibility and robustness to unexpected conditions should be taken care off, in order to find out practical and effective solutions [4].

The present paper deals with the concept of fourth industrial revolution, called Industry 4.0, which allows the achievement of smart, efficient, effective, individualized and customized production solutions at reasonable cost, in the wider context of smart specialisation orientation of industrial clusters defined by European public policies. In brief, having a practical simple approach, it results that with the

help of faster computers, smarter machines, smaller sensors, cheaper data storage and transmission, it is possible to make machines and products smarter and also capable to communicate with each and learn from each other.

2.2 Problem formulation

In this respect, the paper is devoted to make an analyse of the challenges associated to Smart Specialisation priorities, from a dynamic perspective, and targeting to identify new opportunities by mapping regional business and innovation assets, corresponding to their position within the global technological and industrial landscape. The associated case study of the regional clusters environment in Romania, spurring from the S3 initiative, refers to the opportunity to refurbish an old industrial platform from North-East region of Romania, in the new global economic context, and taking into consideration the clustering opportunities associated to the Smart Specialisation strategy of the region. All envisaged economic and social targets are focusing the emerging industries (EI) – new industrial sectors or existing sectors evolving into new industries, as defined by the European Cluster Observatory. The mentoring process, taken into consideration, including the corresponding business models, offered by international strong industrial groups being very effective at global market scale, is intended to represent the fundamentals of capitalization of the existing technological competences, including the associated patent portfolio, in order to influence fast-growing and niche technology fields, and offering relevant insights about the technological potential of the analysed region. All data gathered in the study, developed by the authors, confirm the importance of such a niche market in the North-East region of Romania, as an important resource for employment and supporting the development of a horizontal industry, including many innovative start-ups.

3. CASE STUDY

Our case study is focused on the proposal of reconstruction and development of an Industrial Holding, as a private initiative of creating an innovative regional cluster, covering a Smart

Specialisation priority in the North-East Region of Romania, and assuming the Industry 4.0 concept as its only way to be competitive in the actual global and “aggressive” specialised markets.

3.1 SME integration to Industry 4.0

There is an important need to facilitate the transition of SMEs towards the Industry 4.0 paradigm, to boost their integration into digital / global value chains, complemented with the adoption of specialised digital services and the increasing of data collection associated to their production processes, and comprised in their technological, behavioural and business model change.

So, it is intended that stakeholders should develop common approaches, based on an open source platform, and to reinforce cooperation, together with SMEs and other sectorial clusters, along European value chains, surveying both the demand and supply side and providing demonstrational and development services, to accelerate and catalyse the specific processes.

In this respect, i.e. the North-East Region of Romania is very much interested to become an active part of this process, in the frame of its Smart Specialisation priorities, but also being unfortunately a low income region – a weakness factor in direct connection with its zero Cluster stars in the Sector of Digital Industries, as mentioned in the Cluster Mapping Tool developed by DG Growth of European Commission.

3.2 Digital Innovation Quotient Audit

The IMP³rove Digital Innovation Quotient (DIQ) is a structured assessment of a firm's current performance in digital innovation compared to benchmarks provided by firms across the world. The report highlights the level of digital innovation performance reached by benchmarks – in particular by leading firms. DIQ is based on the competitive performance of an analysed company across different yet intertwined categories of digital innovation. Five key dimensions are evaluated: Digital innovation strategy, Digital business model, Digital processes, Digital ecosystem and culture and Enablers for digital innovation (see Figure 1).

These five dimensions have been identified as key success factors to drive digital innovation, defined as the successful commercialization of new ideas for digital products, services, processes, and business models.

The IMP³rove instrument was used to develop a case study for a company – Hydramold - dealing with fluid power applications, being geographically located in the North-East region of Romania, and targeting global niche markets, for modern engineered solutions in flexible and “strong” machinery tools, with applications in several industries, i.e. energy, mining, rail, infrastructure, agriculture etc.

So, the DIQ radar details Hydramold's performance compared to digital innovation champions and the average in a specific chosen benchmarking class, including the industries mentioned above (see Figure 2). The radar provides an overview of the firm's competitive strengths and weaknesses in each dimension. By comparing the firm's scores with the ones achieved by the digital innovation champions, it creates insights on Hydramold's relative competitive position and potential gaps that need to be addressed. Furthermore, by identifying both strengths and deficiencies, the obtained DIQ radar allows the development of a roadmap to realize the firm's untapped digital innovation potential.

One essential conclusion of the DIQ radar leads to the imperative necessity of integrating Hydramold in a so called “FORTUS” Industrial Holding, as a start-up project, following a validated development strategy, as presented in Figure 3.

3.3 Vision and strategy of Industrial Holding FORTUS

Investment Platform and Start-up Management Fortus Corporation - Industry 4.0, acronym PIM-FCI 4.0, will initiate, develop and implement five major objectives:

1. Building the Start-up of the Joint Company, listed on the Bucharest Stock Exchange, Fortus Corporation - Industry 4.0, according to the American corporate model Actuant Corporation – ATU, listed on the New York Stock Exchange – NYSE;

2. Building Nicolina Plant – Industry 4.0 in the framework of the corporate environment of the World Class Manufacturing System Ecosystem - Lean Manufacturing Industry 4.0, following the Dutch model of HOLMATRO Plant;

3. Building the Industry 4.0 Pilot Module, in partnership with Hydraulic Power Engineering Centre, Department of Machine Tools and Tools, Faculty of Machine Building and Industrial Management from Technical University "Gh. Asachi" of Iasi, like a Pilot Centre for Manufacturing Tools (Hydraulic Power Tools 700-4000 bar and miniBOOSTER as the innovator of solutions that fit virtually any application requiring pressure intensification);

4. Building a New Technology Incubator, in partnership with Tehnopolis Iasi, for Developing New Innovative Products, especially for Customized Products;

5. Building a DMR Hydramold Management Company, in order to achieve Synergic Cooperation, Industry and Product Management 4.0 in High Power Hydraulics for the regional and global market (see Figure 4).

Fortus Corporation – Industry 4.0 is intended to be a corporation in the Engineering and Equipment Industry consisting of PARTNERS (physical or legal persons) and INVESTORS supported by Iasi Local Government, integrated into the synergic digital culture of the Industry 4.0 concept that proposes to manufacture Machinery and Equipment in Industrial, Energy and Engineering Segments, with minimal material and human resources, stimulating and developing Corporate Industry 4.0 manufacturing concept for every employee. Growth and Strategic Development Directions (following the Actuant Model) are:

1. Organic Growth - Innovative OEM Products and Services Attractive Investment in Asset, Intangible and Goodwill, by developing an efficient sales and commercial system for the Global Market;

2. Operational Excellency - Development of an OEM (Original Equipment Manufacturing) - LEAN Management;

3. Collaboration, Strategic Acquisitions and Building a World Class Manufacturing System - Nicolina Industry 4.0;

4. Engagement for increasing the competitiveness of a corporate employee culture, targeting successful and consolidated Business Performance;

5. Delivering outcomes by improving management efficiency, responsibly assuming commitments, and ensuring an enhanced profit for Shareholders.

3.4 Perspectives of future developments

New industries across Romania strive to achieve lean manufacturing, but not every organisation is successful in implementing and achieving its benefits. In the above presentation of the vision and strategy for Industrial Holding FORTUS establishment, complemented with the comprehensive framework of barriers and challenges for lean implementation, we have evaluated and proposed a set of development objectives and directions about how lean manufacturing can be implemented through the technologies of Industry 4.0. I.e., through integrated information and communication systems, the shortcomings of conventional practices can be overcome, in order to improve productivity and eliminate wastes. Thus, it implies that, from now on, High Power Hydraulics Industry in Romania should benefit from the combined benefits of real-time integration of the entire factory along with assurance of minimal waste generation. It is presumed that SMEs in Romania, in general, and in the North-East region of the country, specifically, can positively commit into Industry 4.0 with the perspective of making their production shop-floors lean. Improvements or adaptations of evolution of these Hydraulic Power Tools 700-4000 bar and miniBOOSTER solutions need to be analysed over their influence on lean manufacturing. Moreover, some previous researches in Industry 4.0 were purely theory-oriented, not readily adaptable to an application, such as ours, in the frame of the new intended World Class Manufacturing System - Nicolina Industry 4.0 (see Figures 5 and 6). So, application-oriented future research needs to be focussed on creating a more practical conceptual framework and cyber physical working system, by integrating these parameters in a fully functional production environment.

4. CONCLUSIONS

Digitization and intelligent configuration of manufacturing process is the mandatory necessity for today's industry.

Such very modern approach serves as string premises for implementation of the vision and strategy for Industrial Holding FORTUS establishment. The DIQ radar of Hydramold leads to the imperative necessity of integrating this company in the Start-up Project of creating an Investment Platform and Start-up Management Fortus Corporation - Industry 4.0 (see Figure 7), following a validated development strategy, taken from Actuant Corporation (see Figure 8) and HOLMATRO Plant models.

Our specific case study, associated to the regional clusters environment in Romania, spurring from the S3 initiative, targets the actual opportunity to refurbish an old industrial platform from North-East region of Romania, in the new global economic context, and taking into consideration the clustering opportunities, associated to the Smart Specialisation strategy of the region.

The results of our study confirm the importance of the niche market of Hydraulic Power Tools 700-4000 bar and miniBOOSTER solutions in the North-East region of Romania, as an important resource for employment and

supporting the development of a horizontal industry, including many innovative start-ups, i.e. Start-up of the Joint Company, Fortus Corporation - Industry 4.0. One important asset of Hydramold, as the heart of this Joint Company is its intangible asset portfolio, i.e. its Romanian granted patents, having technical recognition at some Inventions Fairs (Figure 9).

5. ACKNOWLEDGMENTS

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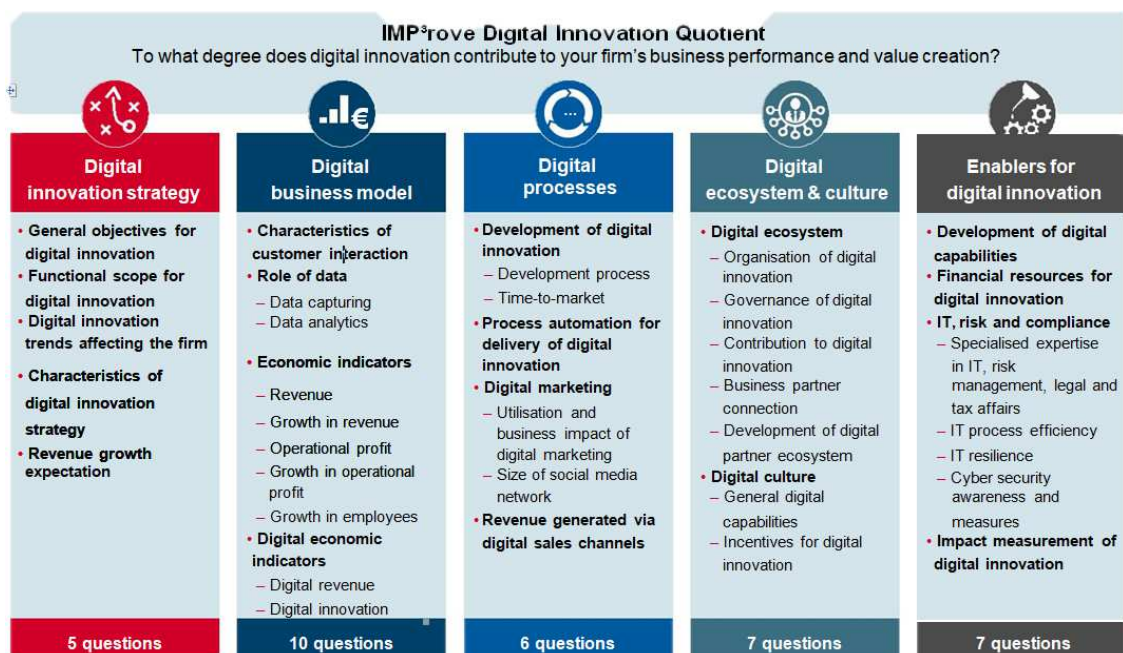


Fig 1. The five dimensions of the Digital Innovation Quotient.

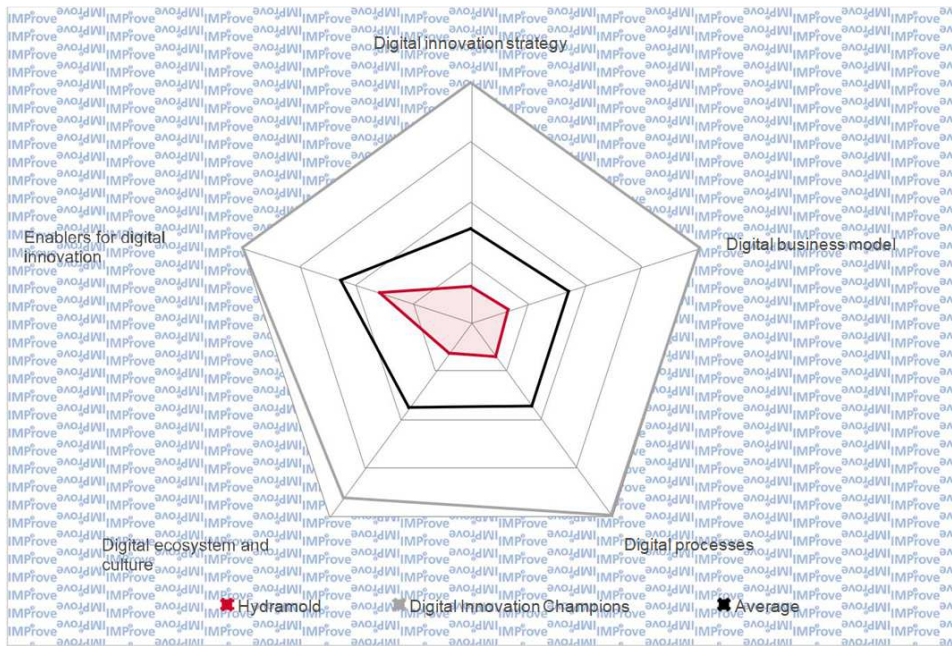


Fig 2. Digital Innovation Quotient - Dimension overview for Hydramold.

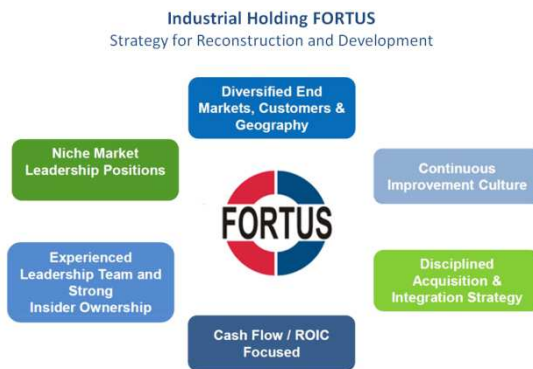


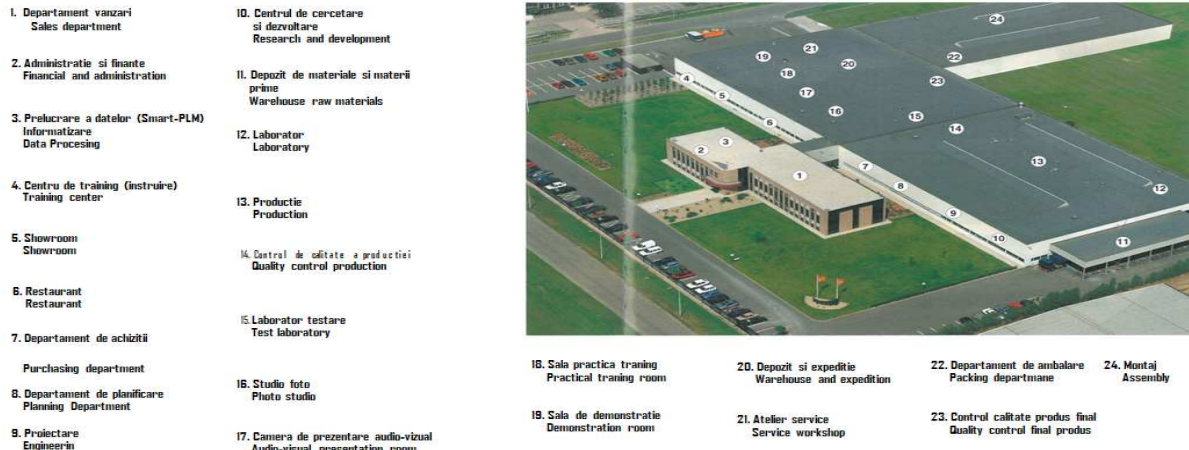
Fig 3. Strategy for Reconstruction and Development of Industrial Holding FORTUS Iași.

Industrial Holding FORTUS
Partners and Market Segments

<u>Industrial</u>	<u>Energy</u>	<u>Engineered Solutions</u>
<p style="text-align: center;">   </p> <p>General Industrial Mining Energy Rail Infrastructure</p> 	<p style="text-align: center;">   </p> <p>Oil & Gas Refinery Power Gen Nuclear Wind Industrial</p> 	<p style="text-align: center;">   </p> <p>Truck Agriculture Off-Highway Auto Medical Defense</p> 

Fig 4. Partners and Market Segments of Industrial Holding FORTUS Iași.

**Smart Plant Nicolina – World-Class Manufacturing System
Industrial Holding FORTUS**



**Fig 5: Layout plan of Smart Plant Nicolina - Industrial Holding FORTUS Iași.
Smart Plant Nicolina – World-Class Manufacturing System
Industrial Holding FORTUS
ASSET 1 and ASSET 2 (City Hall of Iași ownership)**

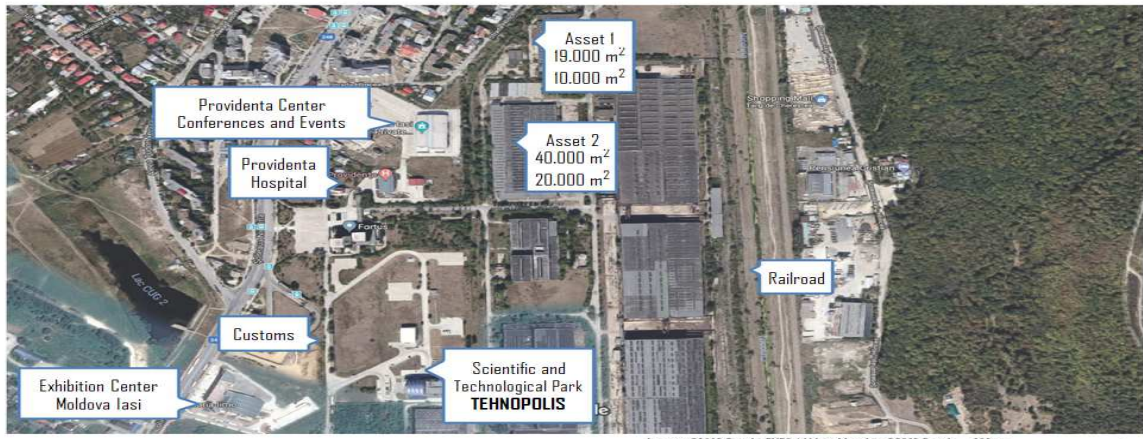


Fig 6: Aerial view of Smart Plant Nicolina - Industrial Holding FORTUS Iași.

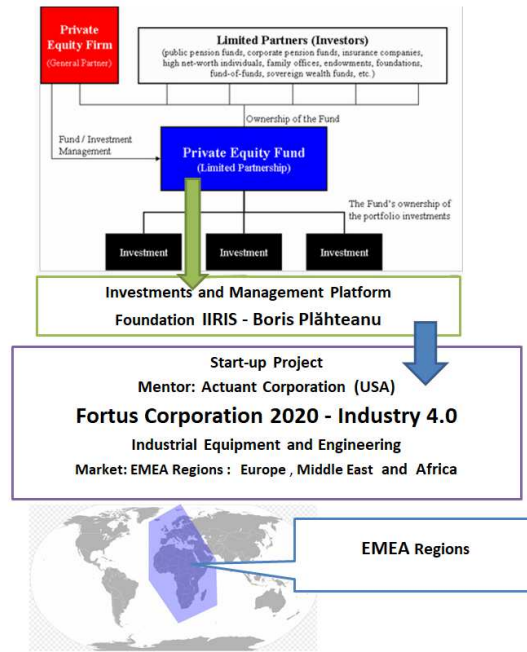


Fig 7. Investment and Management Platform – Start-up Project - Industrial Holding FORTUS Iași.



Fig 8. Business model of the mentor – Actuant Corporation (USA).



Fig 9. Patent portfolio selection and international recognition at Inventions Fairs of Hydramold.

Specializare inteligentă și politici privind clusterelor pentru dezvoltarea capacității de inovare la nivel regional

Rezumat: Lucrarea de față se raportează la conceptul de revoluție industrială – versiunea 4, numit Industria 4.0, care permite realizarea unor soluții de producție inteligentă, eficientă și „personalizată”, la un cost rezonabil, în contextul mai larg al concentrării activității grupurilor industriale pe domenii de specializare inteligentă, susținute prin politici publice în țara noastră. Studiul de caz realizat vizează contextul regional al clusterelor din România, inspirat din inițiativa S3 și se referă la posibilitatea reabilitării unei vechi platforme industriale din regiunea Nord-Est a României, axată pe propunerea de reconstrucție și dezvoltare a unui holding industrial, respectiv o inițiativă privată de creare a unui cluster regional inovativ, care să acopere o prioritate de specializare inteligentă din Regiunea Nord-Est a României, prin asumarea conceptului de Industrie 4.0, ca singura modalitate de a asigura competitivitatea pe piețele specializate actuale, cu caracter global și deosebit de "agresive". Rezultatele studiului nostru confirmă importanța pieței de nișă a echipamentelor hidraulice și soluțiilor miniBOOSTER, specifice domeniului de lucru 700-4000 bar, în regiunea de Nord-Est a României, ca o resursă importantă pentru ocuparea forței de muncă și susținerea dezvoltării unei industrii orizontale, inclusiv a start-up-urilor inovative asociate, prin înființarea și dezvoltarea unui holding industrial, denumit Fortus Corporation - Industry 4.0.

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