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PROSPECTS AND CHALLENGES OF RURAL INDUSTRIES IN BIHAR WITH REFERENCE TO INDUSTRIES 4.0

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Abstract- Developing the industrial sector in Bihar has always been difficult. Bihar's government modifies the State Industrial Policy every five years to entice investors and businesses. Despite the fact that industry accounts for a much smaller proportion of GSDP, it has grown significantly over the last 10 years. Despite the existing delays in Bihar's access to adequate infrastructure and production inputs, there has been a consistent fall in industry's GSDP contribution when compared to the average Indian norm. The State Government established the Industrial Investment Promotion Policy, 2016, to achieve this goal. The main tactic for achieving the objectives of this policy is to focus on the development of support infrastructure while giving priority to the core areas of future development. This policy includes a modified structured package of services, advanced technology, skill development aid, and a well-balanced regional development strategy that extends the benefits of investment in the State's various regions. The goal of this programme is to increase the provision of a specific package of services to socially excluded groups, as well as support for female entrepreneurs. For business owners, the policy includes clear guidance for effective implementation, monitoring, and complaint resolution. The current article also evaluates Bihar's industrial growth severely.

Keywords – Prospects, Challenges, Rural Industries, Industries 4.0, GSDP, Industrial Investment Promotion Policy.

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INTRODUCTION

The next industrial revolution, according to experts, will be fueled by the internet and will involve the communication of people, machines, and products through a vast network called the Cyber Physical System. The fourth stage of industrialization can reduce production costs, improve the quality of the products, and raise consumer satisfaction. Industry 4.0 is a high-tech strategic 2020 action plan that was conceptualised by the German government. Industry 4.0 is defined as "a collective term for technologies and concept of value chain organisation within the modular structured smart factories" by Hermann et al. and Wang et al. Cyber-physical systems keep an eye on bodily functions. Cyber physical systems monitor physical processes, create a visual copy of the physical world, and make decentralised decision over the internet of things. Cyber physical system communicates and cooperate with each other, and human in real time via the internet of services, both internal and cross or ganisational services are o ered and utilised by participants of the value chain". On the other hand, German associations of mechanical engineering, information, and communication technology (ICT), and electrical industry summarized Industry 4.0 as: "In the age of Industry 4.0 products inform machines autonomously what to do with them, objects become intelligent. They have bar codes or RFID chips on them containing relevant information, scanners or computers read out the data forward it online and make sure that the machines act appropriately. That way, the smart objects communicate. An internet of objects and services created. The physical world and the virtual world merge into cyber physical systems".

(i)Industry 4.0: the Prospect Industry- Prospect Industry 4.0 is structured into three segment: horizontal integration; a cross exchange of relevant information along supply chain. A vertical integration: to create exible and recongurable manufacturing system. And end to end engineering integration across en tire value chain to support product customisation.

(ii)Industry 4.0: the challenges- Implementing Industry 4.0 from experts' point of view can be difficult because a satisfactory definition of the term Industry 4.0 does not exist. Other Scholars have expressed concern on its implementation and the requirements for the existing industries to participate. Also, the concern of uncertainty regarding the impacts of industry 4.0 on the general business structure. Would the impact and benefits of industry 4.0 be dependent on the company's size? Or, will it continue to wider the existing gap between large and small businesses?. To demonstrate the greater contribution of small and medium enterprises (SMEs) in the manufacturing as well as employment generation in Germany, in 2012 German Federal statistics reported that, approximately 99% of all enterprises are ranked among Small and Medium scale (SME's) Industries employ ing 60% of all employees, indicating that only about 1% of all German enterprise are large enterprise, employing about 40% of the remaining employees.

LITERATURE REVIEW

Since the 1800s when new manufacturing processes have transformed the industrial landscape, the industrialization technological changes have driven paradigm shifts that are called "industrial (re)evolutions" (Lasi et al., 2014). Currently, industry represents the part of the economy that carries out the production of materials and goods, which are highly mechanized and automatized. Nowadays, the industrial production has reached the edge of a new industrial revolution and the factory of the future has been pictured. The modern manufacturing systems must be flexible/agile, reactive, integrated and cost-effective simultaneously to enable industrial companies to stay competitive in an international competition. To develop and run such complex systems, manufacturing enterprises need to design and engineer their production processes appropriately and in a systematic way following structured approaches based on sound principles and supported by efficient tools and methods (Schelechtendal et al., 2015). Recently, the Industry 4.0 concept (as the fourth industrial revolution) has become an increasingly important issue, being discussed and researched by academics, consultants and companies. However, despite the increasing interest in the Industry 4.0 topic, it is still a non-consensual concept. There are still some vague ideas about this new manufacturing paradigm, regarding its implications and consequences. Also, most companies and factories are not aware of the challenges they may face when they want to implement the Industry 4.0 background. Nevertheless, it has been assumed that there is still a misunderstanding in Industry 4.0 about this topic, especially about what involves Industry 4.0 and its meaning and vision. This new production system allows companies to take actions to prepare for this change, defining the most suitable manufacturing model and planning the target roadmaps in order to address the new industrial paradigm's challenges (MacDougall, 2014). Previous studies were conducted to discuss most features of the mutations of globalized market as market demand for individual and specialized products, shorter life-cycles; need of high flexibility and adaptability of product. To find a solution for that in order to be competitive, the industrial work production systems require a new manufacturing process. Automated mass production might become less economically viable. The purpose of this paper is to provide a comprehensive understanding of the Industry 4.0 concept, with the aim of investigating the challenges, issues, components, benefits, progress and relevance of Industry 4.0 implementation. After this introduction about the new context phenomenon of "Industry 4.0", we present a comprehensive definition of this new concept and explain the research methodology. Then we present several points of view about challenges and issues of Industry 4.0, and most benefits of this new industrial paradigm are also described. Finally, we end this paper by drawing a conclusion and suggesting future research.

INDUSTRY 4.0

Our current business environment is radically changing, and the increasingly demanding and rapidly changing customer needs are the underlying reason that has driven industrial revolutions at different periods. These revolutions have brought to the world drastic changes in diverse areas, posed huge challenges for industries and manufacturers, led to massive innovations and transformations, and remarkably affected people's way of life (Huang, 2017). Currently, the need for flexibility and real time response to the changes in the market is becoming an essential issue (Schlötzer, 2015). Thus, many companies have adjusted their manufacturing process in order to focus on individualised products in a proper time. As we can observe it, the digitalization and virtualization process ensures and procures several opportunities for manufacturers to create new values and drive innovation to achieve more competitive success in their business. Nowadays, all companies must incorporate innovation in their manufacturing process and in order to sustain in the context of globalization and guarantee more perfection production systems which are characterised by flexibility, adaptability, agility, proactivity and so on. The manufacturing automation (called Industry 4.0 or smart factory) is the ultimate path to this. Therefore, the smart factory plays the main role of optimising the movement of goods by providing the necessary information for the proper operator in the proper moment (Schlötzer, 2015). The core of this Industry 4.0 is Internet of things which allows connection of machines, products, systems and people. In short, the term Industry 4.0 appeared published for the first time in November 2011 by the German government that resulted from an initiative regarding high-tech strategy for 2020 and since then this concept is used across Europe. In the United States and more generally the English speaking world, terms such as "The Internet of Things" or the "Internet of Everything" are also used (Deloitte, 2014). It can be defined as the embedding of smart products into digital and physical processes. Digital and physical processes interact with each other and with cross-geographical and organizational boundaries (Schmidt et al., 2015). In order to understand Industry 4.0 accurately, some recent definitions are presented including an overview as shown in Table1. According to Surah et al. (2018), Industry 4.0 as the fourth industrial revolution is characterised by a combination of new technical components and main principles to design and form this concept, in order to get a horizontal and vertical integration or value networks (Schmidt et al., 2015).

The main components that form the concept of Industry 4.0 are:

1- Identification (RFID systems): The first step is the identification of the processing good.
2- Locating (RTLS): Identification used to be associated with locating or recording the place of identification; in order to locate it, real time locating systems (RTLS) are used.
3- Sensing or Cyber-physical system (CPS): It is the term that describes the unification of digital (cyber) with real (physical) workflows. In manufacturing, this means that the physical production steps are accompanied by computed based processes, using the concept ubiquitous computing. A CPS includes sensors and actuators by which it can collect and send data. Sensing provides the function of the right condition for the logistics system.

Authors	Industry 4.0
Koch et al. (2014)	"The term Industry 4.0 stands for the fourth industrial revolution and is best understood as a new level of organization and control over the entire value chain of the life cycle of products, it is geared towards increasingly individualized customer

	requirements”.
MacDougall (2014)	“Industry 4.0 or Smart industry refers to the technological evolution from embedded systems to cyber-physical systems. It connects embedded system production technologies and smart production processes to pave the way to a new technological age which will radically transform industry and production value chains and business models”.
McKinsey Digital (2015)	“Industry 4.0 seen as a digitization of the manufacturing sector, with embedded sensors in virtually all product components and manufacturing equipment, ubiquitous cyber physical systems, and analysis of all relevant data”.
Deloitte AG (2015)	“The term Industry 4.0 refers to a further development stage in the organization and management of the entire value chain process involved in manufacturing industry”.
Geissbauer et al. (2016)	“Industry 4.0 - the fourth industrial revolution, focuses on the end-to-end digitization of all physical assets and integration into digital ecosystems with value chain partners”.
Pfohl et al. (2015)	“Industry 4.0 is the sum of all disruptive innovations derived and implemented in a value chain to address the trends of digitalization, automization, transparency, mobility, modularization, network collaboration and socializing of products and processes”.
Hermann et al. (2015)	“Industrie 4.0 is a collective term for technologies and concepts of value chain organization. Within the modular structured Smart Factories of Industrie 4.0, CPS monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the IoT, CPS communicate and cooperate with each other and humans in real time. Via the IoS, both internal and cross organizational services are offered and utilized by participants of the value chain”.

Table1. Industry 4.0 definitions

4- Networking or Internet of things (IoT): With IoT, enterprises can supervise their every product in real time and manage their logistics architecture. IoT is part of the CPS that enables the communication with other CPS and between the CPS and users.
5- Data collection and analysis (Big Data and Data Mining): Logistics 4.0 implies a huge increase of variety, volume and velocity of data creation. The types and amount of collected data have increased because of the advances in sensor technology and the products containing computed capacities.
6- Business Service or Internet of services (IoS): This enables service vendors to offer their services via Internet. It consists of participants, infrastructure for services, business models and the services themselves.

The main implementation principles as reviewed in several researches (L. Domingo, 2016; Obitko and Jirkovsky, 2015) and recognised by The German Commission for Electrical, Electronic & Information Technologies of DIN and VDE (2013) are:

1- Interoperability, where standardization and semantic descriptions are important, since it means that companies, humans and CPS are connected by IoT and IoS.

2- Virtualization, over the CPS, the physical world can be linked to the virtual. In other words, the data from sensors are linked to virtual and simulation models. Thus, a virtual copy of the physical world is created and enables the CPS to monitor physical processes.

3- Real time capability, a continuous data analysis is needed to react to any changes in the environment in real time, such as routing or handling failures.

4- Decentralization, that means giving autonomy, resources and responsibility to lower levels of the organizational hierarchy. Individual agents have to make decisions on their own and delegate the decisions to higher levels in the event of failures or complex situations.

5- Service orientation. Service-orientated architecture (SOA), an architectural pattern in computer software design in which application components provide services to other components via a communication protocol, typically over network, allows encapsulation of various services to combine them and to facilitate their utilization.

6- Security of information and its privacy shall be emphasized in the data exchange using ICT technologies.

In short, industry 4.0, as the fourth industrial revolution, has a mission to emphasize the end-to-end digitization of all physical assets and integration into digital ecosystems with value chain partners; it refers to an extra development step in the organization and management of the entire value chain process involved in the manufacturing industry. This new concept means a combination of technologies and concepts of value chain organization. Within the modular structured Smart Factories of Industry 4.0, the CPS monitors physical processes, creates a virtual copy of the physical world and makes decentralized decisions. Over the IoT, the CPSs communicate and cooperate with each other and with humans in real time. Via the IoS, both internal and cross organizational services are offered and utilized by participants of the value chain for increasingly individualized customer requirements and products (Koch et al., 2014).

CHALLENGES AND ISSUES OF IMPLEMENTING INDUSTRY 4.0

According to Pereira et al. (2017), the quest of applying Industry 4.0 brings diverse technological challenges, with high influences on many dimensions in today’s manufacturing industry. Thus, it is essential to develop a strategy for all the actors involved in the entire value chain, to reach a consensus on security issues and the relevant architecture before implementation begins (Wan, and Zhou, 2016). Moreover, numerous authors state that implementing Industry 4.0 is a hard mission and it is likely to take ten or more years to be realized. Adopting this new manufacturing process involves many aspects, and faces many types of difficulties and challenges, including scientific, technological, and economic challenges, social problems as well as political issues. The most challenging aspects for the organizations that wish to adopt this new approach are touch skills and qualifications of their workers concerning e.g. problem-solving skills, failure analysis, the ability to deal with constant changes and completely new tasks. Indeed, they should be able to trial with specific Industry 4.0 technologies with new complexity tasks: the collection, processing and visualization of manufacturing process data (Hendrik Unger et al., 2017). As we know at this moment there are few studies in the field of engineering and management teaching and needs of students and of the industrial workforce are changing (Barbara Motyl et al., 2017). Industry 4.0 will lead to potential deep changes in several domains that go beyond the industrial sector and allow the creation of new business models (Carvalho et al., 2018). Other challenges and issues of firms are related to innovation, technological components, digital transformation advancements and the rising interconnectivity developments which play an important role in every organization. As mentioned above, Industry 4.0 which consists of providing a new way of manufacturing is closely associated with the end-to-end digitization of all physical assets and with the integration into digital ecosystems of all value chain partners. Though, according to a McKinsey and company study (2015), the majority of companies, especially the small and medium-sized enterprises in the industry, seem rather unwilling to start the digital transformation process and the hesitation has to do with a number of implementation barriers faced by manufacturers with no/limited progress in Industry 4.0 (D, Kü sters et al., 2017). Iyer (2018) indicates that manufacturing is now bringing about both opportunities and challenges, so neither business leaders nor policy makers can rely on old responses in the new manufacturing environment. Thus, a serious challenge of manufacturers will be to address decision-making based on a number of factors: wages, inventory, requirements, logistics etc. to name a few. The result could very well be a new kind of global manufacturing company a networked enterprise that uses “big data” and analytics to respond quickly and decisively to changing conditions and can also pursue long-term opportunities. “Even though we have all the enablers to make Industry 4.0 feasible such as connectivity technology, affordable IoT hardware, standardized communication protocol, collecting meaningful data and analyzing for implications are still the biggest challenges to driving the impact from Industry 4.0.” (McKinsey and company, 2015; p. 45). In short, Table 2 provides an overview of the main challenges and issues of implementing Industry 4.0.

CONCLUSION

Industry 4.0's theoretically designed smart factory has four distinct layers: the physical layer, which houses smart products, smart machines, and smart conveyors. engage with one another through an industrial network in order to fulfil the specifications of the product design in a self-contained, independent manufacturing system that relies on an industrial network and intelligent negotiation tools. With the help of new information technologies like the internet of things (IoT), big data, cloud computing, and artificial intelligence technologies, these interdependent systems can be completely realised. These interrelationships could experience problems while being implemented or integrated. As a result, momentum should be maintained, along with technical enhancements, the design of workable prototypes, and a focus on enabling technologies.

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