

Creating Competitive Advantage through Source Basic Capital Strategic Humanity in the Industrial Age 4.0

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Abstract— Industry 4.0 was born from the idea of the fourth industrial revolution. Its existence offers many potential benefits. The main objective of this article is to offer a perspective and suggest competitive advantage practices through the best human resources for business in the face of the fourth industrial revolution. This is done by integrating existing literature with logical beliefs. Industry Business Environment 4.0, the main objectives and challenges of Industry 4.0 are discussed here. This article will focus on the business environment in the Industry 4.0 era which covers the main objectives and challenges faced, so that the challenges that exist in Industry 4.0 can be transformed into opportunities in the face of competition through innovation. As a result, we now need to identify the challenges of Industry 4.0 in anticipation of carrying out it, while the challenges are 1) information technology security issues; 2) reliability and stability of production machines; 3) lack of adequate skills; 4) reluctance to change by stakeholders; and 5) loss of a lot of work because it turns into automation. For that we need to anticipate the challenges that exist by creating strategic advantages with human resources who are ready to compete.

Keywords—Competitive Advantage; Industry 4.0; Human Resources.

I. INTRODUCTION

Today's industrial world, especially in Indonesia is facing a new industrial era, this is marked by the era of digitalization in various multidimensional sectors. Experts call it the Industrial Revolution 4.0 era. The change in the dynamics of the original centralized rate of movement that humans as vital subjects in the growth and development of the pulse of the economy has undergone a shift that is slowly but steadily replaced by mechanical automation and technological digitalization in driving the economy.

Quoting Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation, which was released by McKinsey Global Institute (December 2017), it was mentioned that industrial revolution 4.0 made 800 million jobs lost from the face of the earth until 2030 because human power was replaced by automation robot. The results of this study illustrate that every human being who still wants to have self-existence in global competition must prepare mentally and skill that has a competitive advantage from others, so the main way to prepare skills that is easiest to do is to have a behavior that good (behavioral attitude), increase self-competence and have a literacy spirit. Provision of self-preparation can be passed with the education path (long life education) and self-concept through the experience of working across generations/across disciplines (experience is the best teacher).

Innovation in automation is growing with the creation of super computers, robotic artificial intelligence and genetic modification that have created a world that is very different from the previous world. And the logical consequence that must be borne together is the change and shift in the type of labor in the present era (the present era) and the future. At present changes and shifts in labor-intensive sectors of labor have begun to be replaced by automation and digitization of machinery already around us and already entering remote villages where communal places are available for labor. For example, in the agrarian sector, when farmers planted rice harvesting which had been carried out together in a demonstrative manner because a lot of labor was needed, today can be seen carefully the process of productivity is done by one to two people to move the engine available.

The implications of the Industrial Revolution 4.0 are like the two eyes of money, on the one hand it has a positive value for productivity of work and the efficiency of the production process, but on the other hand, the competitive world of work which leads to a large number of unused labor will be a serious social problem for the pillar political or economic stability of a country. Receiving changes is a necessity of life must be followed by preparing themselves to face these changes by developing themselves and increasing self-competence through the synergy of the Industrial Revolution 4.0 with a mental revolution.

The term Industry 4.0 was born from the idea of the fourth industrial revolution. The European Parliamentary Research Service in Davies (2015) stated that the industrial revolution took place four times. The first industrial revolution took place in England in 1784 where the discovery of steam engines and mechanization began to replace human work. The second revolution occurred at the end of the 19th century where production machinery powered by electricity was used for mass production activities. The use of computer technology for manufacturing automation from 1970 became a sign of the third industrial revolution. At present, the rapid development of sensor, interconnection and data analysis technology has led to the idea of integrating all of these technologies into various industrial fields. This idea is predicted to become the next industrial revolution. Number four in the term Industry 4.0 refers to the fourth revolution. Industry 4.0 is a unique phenomenon compared to the three industrial revolutions that preceded it. Industry 4.0 was announced a priori because the

real events had not yet occurred and were still in the form of ideas. (Drath dan Horch, 2014).

The term Industry 4.0 itself was officially born in Germany precisely at the Hannover Fair in 2011 (Kagermann et al., 2011). Germany has a big interest in this matter because Industry 4.0 is part of its development plan policy called the High Tech Strategy 2020. The policy aims to keep Germany always at the forefront of manufacturing (Heng, 2014). Several other countries also participated in realizing the concept of Industry 4.0 but used different terms such as Smart Factories, Industrial Internet of Things, Smart Industry, or Advanced Manufacturing. Even though they have different terms, they all have the same goal, namely to improve the competitiveness of the industry in each country in the face of a very dynamic global market. This condition is caused by the rapid development of the use of digital technology in various fields.

Industry 4.0 is predicted to have great potential benefits. Most opinions regarding the potential benefits of Industry 4.0 are about improving the speed of production flexibility, improving service to customers and increasing revenue. The realization of the potential benefits will have a positive impact on the economy of a country. Industry 4.0 does offer many benefits, but also has challenges to face. Drath and Horch (2014) argue that the challenge faced by a country when implementing Industry 4.0 is the emergence of resistance to changes in demography and social aspects, instability in political conditions, limited resources, natural disaster risk and demands for the application of environmentally friendly technologies. According to Jian Qin et al. In Olivia Natalie (2018), there are quite wide gaps in terms of technology between the current conditions of the industrial world and the expected conditions of Industry 4.0. Research conducted by Balasingham (2016) also shows that there is a factor in the company's reluctance to implement Industry 4.0 because of concerns about the uncertainty of its benefits.

Based on some of these explanations, according to what was stated by Zhou et al. (2015), in general there were five major challenges to be faced, namely the aspects of knowledge, technology, economics, social and politics. In order to answer the challenge, a large, planned and strategic effort is needed from the side of the regulator (government), academics and practitioners. Kagermann et al. (2013) conveyed the need for the involvement of academics in the form of research and development to realize Industry 4.0. According to Jian Qin et al. in Olivia Natalie (2018), the technology development roadmap to realize Industry 4.0 is still not directed. This happens because Industry 4.0 is still in the form of ideas whose concrete manifestations of all aspects are unclear so that it can bring up various possible directions for development.

This article aims to examine the aspects and direction of research development related to Industry 4.0. The approach used is a study of various definitions and models of the Industrial 4.0 framework and through mapping and analysis of a number of publications. The contents of this article include a study of the definition and model of Industry 4.0 framework to find out what aspects are in the concept of Industry 4.0. Next

is an explanation of the method to trace the direction of development of Industrial research 4.0, followed by a discussion of the results and conclusions. This article is expected to provide an overview of what Industry 4.0 is, the development and potential of research that is in it to create competitive advantage through strategic HR capital base.

Definition of Industry 4.0

The definition of Industry 4.0 varies because it is still in the research and development stage. German Chancellor Angela Merkel (2014) argues that Industry 4.0 is a comprehensive transformation of all aspects of production in the industry through the incorporation of digital and internet technology with conventional industries. Schlechtendahl et al. (2015) emphasize the definition of the speed element of information availability, namely an industrial environment in which all entities are always connected and able to share information with one another.

A more technical understanding is conveyed by Kagermann et al. (2013) that Industry 4.0 is the integration of Cyber Physical System (CPS) and Internet of Things and Services (IoT and IoS) into industrial processes including manufacturing and logistics and other processes. CPS is a technology to combine the real world with cyberspace. This merger can be realized through integration between physical and computational processes (embedded computers and network technologies) in a close loop (Lee, 2008). Hermann et al (2016) added that Industry 4.0 is the term to refer to a set of value chain technologies and organizations in the form of smart factories, CPS, IoT and IoS. Smart factory is a modular factory with CPS technology that monitors the physical process of production and then displays it virtually and decentralizes decision making. Through IoT, CPS is able to communicate with each other and work together in real time including with humans. IoS is all service applications that can be utilized by every stakeholder both internally and between organizations. There are six industrial design principles 4.0, namely interoperability, virtualization, decentralization, real time capabilities, service oriented and are modular. Based on some of the above explanations, Industry 4.0 can be interpreted as an industrial era where all entities within it can communicate in real time at any time based on the use of internet and CPS technology to achieve the goal of creating new values or optimizing existing values from each process in the industry.

The Concept of the Industrial Revolution

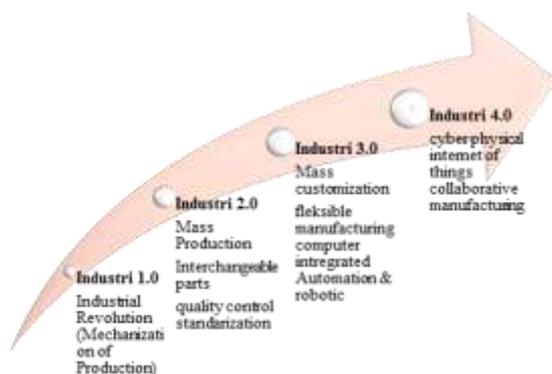
Referring to the literature of the Great Indonesian Language Dictionary (KBBI) the Industrial Revolution consists of two (2) words namely revolution and industry. Revolution means that changes are very fast, while the notion of industry is an effort to carry out the production process. When the red thread is drawn, the definition of industrial revolution is a change that takes place quickly in the production process where the original work of the production process which was originally done by humans is replaced by a machine, while the goods produced have commercial value added.

In the context of the industrial revolution it can be translated that the process that occurs actually is a social and cultural change that takes place quickly and concerns the basic needs (needs) with the wants (wants) of the community. The journey of change in the revolution that occurs can be planned or without prior planning and can be carried out without violence or through violence.

The basis of this change is actually the fulfillment of desire and the fulfillment of human needs quickly and with quality. The Industrial Revolution has changed the way humans work from manual use to automation or digitalization and innovation is the key to the existence of change itself.

Innovation is the most important factor that determines the competitiveness of a country or company. The results of future innovation achievements are determined to what extent can formulate a body of knowledge related to innovation management, technology transfer and business incubation, science and Technopark.

The term "Industrial Revolution" was introduced by Friedrich Engels and Louis-Auguste Blanqui in the mid-19th century. This industrial revolution is also running from time to time. The last decade has been called entering the fourth phase (4.0). Changes in phase to phase give articulatory differences in terms of their use. The first phase (1.0) is concerned with the discovery of machines that emphasize (stressing) the mechanization of production. The second phase (2.0) has moved on to an integrated mass production stage with quality control and standardization. The third phase (3.0) enters the stage of mass uniformity which relies on computerized integration. The fourth phase (4.0) has presented digitalization and automation of internet integration with manufacturing (BKSTI 2017).



Hermann et al. (2016) added, there are four design principles of Industry 4.0. First, interconnection (connection), namely the ability of machines, devices, sensors, and people to connect and communicate with each other through the Internet of Things (IoT) or the Internet of People (IoP). This principle requires collaboration, security, and standards. Second, information transparency is an information system's ability to create virtual copies of the physical world by enriching digital models with sensor data including data analysis and information provision. Third, technical assistance which includes; (a) the ability of the assistance system to support humans by combining and evaluating information consciously

to make the right decisions and solve urgent problems in a short time; (b) the ability of the system to support humans by carrying out various tasks that are unpleasant, too tiring, or unsafe; (c) includes visual and physical assistance. Fourth, decentralized decisions which are the ability of the physical and virtual systems to make their own decisions in carrying out tasks as effectively as possible. Simply stated, the principle of Industry 4.0 according to Hermann et al (2016) can be described as follows.

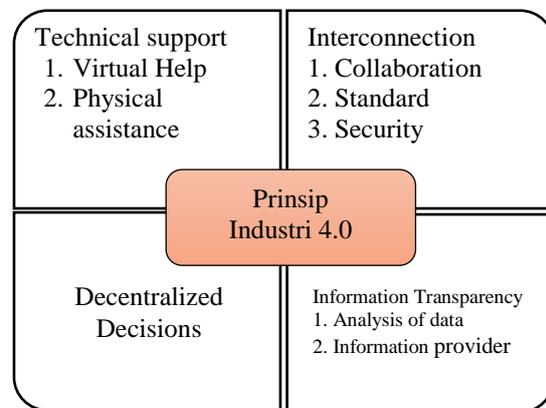


Fig. 1. Industry Principles 4.0

(Source: Herman et al., 2016)

Industry 4.0 has introduced flexible mass production technology (Kagermann et al, 2013). The machine will operate independently or coordinate with humans (Sung, 2017). Industry 4.0 is an approach to control the production process by synchronizing time by integrating and adjusting production (Kohler & Weisz, 2016). Furthermore, according to Zesulka et al in Yahya (2018) added, Industry 4.0 is used on three interrelated factors namely; 1) digitization and economic interaction with simple techniques towards economic networks with complex techniques; 2) digitizing products and services; and 3) new market models. Baur and Wee (2015) mapped Industry 4.0 with the term "digital compass" as follows.



Fig. 2. Industry Level 4.0

(Source: Baur & Wee, 2015)

Figure 2 is an instrument for companies in implementing Industry 4.0 to fit their needs. In the picture 2 components of labor (labor), must fulfill; 1) collaboration between humans and robots; 2) remote control and control; 3) digital performance management; and 4) automation of work knowledge. Similarly, other components are used as instruments for implementing Industry 4.0.

The digital revolution and the era of technological disruption are other terms of Industry 4.0. Called the digital revolution because of the proliferation of computers and the automation of records in all fields. Industry 4.0 is said to be an era of technological disruption because automation and connectivity in a field will make the movement of the industrial world and work competition not linear. One of the unique characteristics of Industry 4.0 is the application of artificial intelligence (Tjandrawinata, 2016). One form of application is the use of robots to replace human power so that it is cheaper, effective, and efficient.

TABLE 1. Industry Aspects 4.0

No	Aspect	Description
1	Standardization	Covers all efforts to develop standards and references in the implementation of Industry 4.0
2	Modeling	Includes efforts to model complex systems in the industry
3	Communication network	Availability of hardware or software technology for fast and real time exchange of information and data.
4	Safety and security	Everything related to the security of data processing systems and the security of the use of technology for humans.
5	Human Resources	Includes efforts to transform human resources to be ready to face changes due to Industry 4.0
6	Law	Includes efforts to develop a legal framework in the implementation of Industry 4.0 (contracts, agreements, rules, etc.).
7	Resource efficiency	Covering all efforts to make efficient resources (energy, costs, etc.) due to the implementation of Industry 4.0 technology
8	Technology	All efforts related to technology development in order to develop HR virtualization, which is the key to Industry 4.0 technology
9	Smart Factory	Includes the development of automated, intelligent, modular and adaptive manufacturing / production systems
10	Business	Includes the discovery of new business models or changes in business processes due to the application of Industry 4.0.
11	Work design	Includes development and research related to changes in work systems that will be faced by workers.
12	Services	Covers all efforts in processing big data and making applications for its use
13	Management and Organization	Related to changes and development of management and organization models due to the application of Industry 4.0.
14	End to end product engineering	Related to engineering products or services that are digitalized during their life cycle (smart product).

The Concept of Competitive Advantage

Competitive advantage is the ability of companies to formulate strategies to achieve profit opportunities through

maximizing revenue from investments made, at least there are two basic principles that companies need to have to achieve competitive advantage, namely the value of customers' views and product uniqueness.

The customer value perspective is the view of the customer that they get a certain value from economic transactions with the company, in this case the company must focus on customer needs and expectations. While the angle of uniqueness characterized by goods and services produced by the company cannot be easily imitated by competitors. There are 3 important points in competitive advantage, namely:

- 1) Not satisfied just relying on physical resources to become a formidable competitor.
- 2) There are no innovative computer applications that provide a competitive advantage for the company continuously.
- 3) Focusing information resources on customers.

Challenges of Human Resource Management

In the current era of Industry 4.0 the competitiveness of companies no longer lies in excellence in the field of product and process technology or has a market that is protected and regulated or has capital but precisely in the possession of weak quality human resources. Human resources are assets that are difficult to trade or emulate, rare, suitable that provide a sustainable competitive advantage for the company. This opinion was also echoed by CEO General Electric, Jack Welch, who said the only way GE competed was the superiority of human resources. Likewise, the CEO of Chhrysler Corp and Unilever NV said that the human resources are being used as capital in facing globalization (Schuler and Jackson, 1997). The importance of the role of manuis resources as the main foundation of the company in gaining competitive advantage is due to changes in the environment that create new challenges for the organization. (Ulrich, 1997).

There are eight competitive challenges faced by companies in the present and future as follows:

No	Competitive Challenges	Information
1	Globalization of Globalization	is a state of diversity, ambiguity and complexity or unlimited unification of the world. In the context of this challenge, companies must be able to improve their ability to learn and work together, manage differences, ambiguity and complexity. An important role in the function of global human resource management is the ability to increase adaptation and coordination. Consequently a long-term strategy is needed in anticipating and responding to changes in the company to be more competitive in the world market.
2	Competence and intellectual capital	Competence and intellectual capital require companies to be required to obtain human resources who have expertise, perspectives and experience in managing global business.
3	Profitability throught cost and growth	Every company is required to obtain profitability through efficiency or savings in production costs, human resource costs and other expenses. On the other hand to increase revenue growth by attracting consumers and

No	Competitive Challenges	Information
		always being innovative in creating new products.
4	Technologi	The existence of technology has resulted in a faster production process and a smaller world. This challenge requires managers to be able to make the technology offered easy to use and useful.
5	Capability	Focus on Capability involves tangible capabilities such as technology possessed and intangible capabilities such as the ability to change, be flexible, have self-confidence and achievement motivation etc.
6	Change	Focus on Capability involves tangible capabilities such as technology that is possessed and intangible such as ability to change, be flexible, have self-confidence and achievement motivation etc.
7	Value chain for business competitiveness and HR services	Customer responseive value chain
8	Turnround is not transformation	Transformation that emphasizes fundamental change. These environmental changes require companies to always improve their performance or productivity.

Source: Ulrich (1997)

The competitive challenges faced by companies in the present and future can be anticipated by human resource management strategies that can respond to environmental changes that occur.

Role of Basic Capital Management of Human Resources in the era of Industry 4.0

With the increasingly complex challenges, the role of HRM in achieving competitive advantage is not only to handle personnel issues but must be a pioneer in facing an ever-changing environment from time to time, as happened in the current Industrial 4.0 era. According to Ulrich (1997) there are four new roles that must be played by HRM to form a company that has a competitive advantage. This role can be seen in the picture below.

- Strategic partner: The role of HRM as a strategic partner, meaning that HRM is required to have the ability to translate vision, mission and business strategy into HR strategy policies.
- Administrative expert: Acting as an administrative expert, meaning HR that provides design and service for HRM systems that are efficient and effective in both the process and implementation. Includes a selection system, training, development, awards for labor, promotion and other HR management.
- Employee Champion: In the role of an Employee Champion HRM must be able to increase the commitment and contribution of the workforce to achieve organizational success and be a protector of the workforce. Some of the things that must be done by HRM as an Employee Champion are a) HRM must actively understand the needs of the workforce and ensure that these needs can be met both in quality and quantity. b). HRM must be able to involve line managers in creating workforce

contributions in the organization. c). HRM must assist the workforce to increase the contribution and commitment they have to work in a quality manner.

- Change Agent: The role of HRM in Industry 4.0 is to transform change in the face of competitive change by building organizational capacity to be able to respond to change and must be responsible for designing and managing change and acting as a catalyst/sponsor, facilitator and demonstrator.

II. METHODS

The method used in this study is a qualitative descriptive method that aims to know competitive practices through competitive human resources in the face of the Industrial Revolution 4.0 era. This study was conducted by integrating literature, previous research and various articles with logical beliefs. The results of this study are in the form of information about creating competitive advantage in the era of Industry 4.0. In addition, this article provides an overview of the competencies, aspects, descriptions and competitive challenges faced today and in the future.

The industry challenges 4.0 discussed in this article are 1) economic challenges; 2) social challenges; 3) technical challenges; 4) environmental challenges; and 5) political challenges and rules.

III. RESULTS AND DISCUSSION

The main purpose of this article is to offer a perspective, and suggest in the practice of competitive advantage through the best human resources for the business world in the face of the fourth industrial revolution. This is done by integrating existing literature with logical beliefs. This article will focus on the business environment in the Industry 4.0 era which covers the main objectives and challenges faced, so that the challenges that exist in Industry 4.0 can be transformed into opportunities in the face of competition through innovation.

Technological advancements allow for automation in almost all fields. New technologies and approaches that combine the physical, digital, and biological worlds will fundamentally change patterns of life and human interaction (Tjandrawinata, 2016). Industry 4.0 as a technological revolution phase changes the way human activities operate in scale, scope, complexity, and transformation from previous life experiences. Humans will even live in global uncertainty, therefore humans must have the ability to predict a rapidly changing future. Every country must respond to these changes in an integrated and comprehensive manner. The response must involve all global political stakeholders, ranging from the public, private sector, academia, to civil society so that the challenges of Industry 4.0 can be managed as opportunities.

Wolter identified challenges in Industry 4.0 as follows: 1) information technology security issues; 2) reliability and stability of production machines; 3) lack of adequate skills; 4) reluctance to change by stakeholders; and 5) loss of a lot of work because it changes to automation (Sung, 2017). More specifically, Hecklau et al in Yahya (2018) explained the challenges of Industry 4.0 as follows.

TABLE 2. Challenges in Industry 4.0

No	Challenge	Information
1	Economic challenges	<ol style="list-style-type: none"> Continuing globalization: <ol style="list-style-type: none"> Intercultural skills Language ability Time flexibility Network skills Understanding the process Increased need for innovation: <ol style="list-style-type: none"> Entrepreneurial thinking Creativity, Solution to problem Work under pressure Current knowledge Technical skills Research skills Understanding the process Requests for higher service orientation: <ol style="list-style-type: none"> Conflict resolution Communication skills Ability to compromise Networking skills Growing the need for collaboration and collaboration: <ol style="list-style-type: none"> Able to compromise and cooperative Ability to work in teams Communication skills Networking skills
2	Social challenges	<ol style="list-style-type: none"> Changes in demographics and social values: <ol style="list-style-type: none"> The ability to transfer knowledge Acceptance of work task rotation and related work changes (tolerance for ambiguity) Time and place flexibility Leadership skills Increased virtual work: <ol style="list-style-type: none"> Time and place flexibility Technology skills Media skills Understanding of IT security Growth of process complexity: <ol style="list-style-type: none"> Technical skills Understanding the process Motivation to learn Tolerance of ambiguity Decision-making Problem solving Analytical skills
3	Technical Challenges	<ol style="list-style-type: none"> Technological development and exponential data usage: <ol style="list-style-type: none"> Technical skills Analytical ability Efficiency in working with data Coding skills The ability to understand IT security Obedience Grow collaborative work: <ol style="list-style-type: none"> Able to work in teams Virtual communication capabilities Media skills Understanding of IT security Ability to behave cooperative
4	Environmental Challenges	Climate change and scarcity of resources: <ol style="list-style-type: none"> Continuous mindset Motivation to protect the environment Creativity to develop new sustainability solutions
5	Political and Rules Challenges	<ol style="list-style-type: none"> Standardization: <ol style="list-style-type: none"> Technical skills Coding skills

No	Challenge	Information
		<ol style="list-style-type: none"> Understanding the process Data security and privacy: <ol style="list-style-type: none"> Understanding of technology security information Obedience

Source: Heckeu et al., 2016 (processed)

Irianto (2017) simplifies the challenges of Industry 4.0 as follows; (1) industry readiness; (2) trusted workforce; (3) ease of socio-cultural arrangements; and (4) diversification and job creation. While the opportunities for Industry 4.0 are; (1) ecosystem innovation; (2) competitive industrial base; (3) investment in technology; and (4) integration of Small and Medium Enterprises (SMEs) and entrepreneurship. Mapping the challenges and opportunities of Industry 4.0 to prevent various impacts on people's lives, one of which is the problem of unemployment. 2017 Work Employment and Social Outlook Trends predicts the number of unemployed people globally in 2018 is estimated to reach 204 million with an additional increase of 2.7 million. Almost the same as the condition experienced.

To deal with the challenges outlined above, now we need to get human resources who can compete in all fields that are multidimensional. HR Professional Competence in the Industry 4.0 era is very much needed. In order to be able to play this role, a professional in the field of HRM is required to have the following competencies:

- Business competence:** HR managers in taking HR policies must first understand the company's business and know financial capabilities and can calculate the costs and benefits of each alternative HR policy but also the social and ethical impacts of its implementation.
- Professional and technical knowledge:** In the implementation of human resource management must be professional, have technical knowledge such as placement, employee development, appreciation, organizational design, communication and performance assessment so that implementation is as expected.
- Ability to manage change:** HR managers must have the ability to manage change from diagnosing problems, implementing and evaluating changes in other words HR managers must be able to improve the quality of human resources in accordance with the changes made.
- Integration competence:** HR managers must be able to integrate workforce competencies to be able to work with quality, effective and efficient.

IV. CONCLUSIONS

In the face of increasingly fierce competition companies must be able to manage human resources well in order to have a competitive advantage. For this reason, it is necessary to change the role of HRM not only as an administrative expert, but also as a strategic partner, champion employee and change agent. Changes in this role resulted in the HRM strategy tailored to the company's strategy and HR managers must be able to provide quality human resources so that the company's goals can be achieved.

Industry 4.0 brings many changes in human life. Industry 4.0 has fundamentally changed the way people move and has a big influence on the world of work. The positive influence of Industry 4.0 is in the form of effectiveness and efficiency of resources and production costs even though it has an impact on reducing employment. Industry 4.0 requires workers who have skills in digital literacy, technology literacy, and human literacy. Vocational education must be able to equip graduates with these three literacies through chronosystem revitalization which includes learning systems, educational units, students, and educators and education staff.

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