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Implementation Analysis of the Industrial Revolution 4.0 in The Electronic Industry

Eko Setiobudi

Sekolah Tinggi Ilmu Ekonomi Tribuana
Email:ekosetiobudi@gmail.com

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Abstract:
Productivity, efficiency and added value are something that the industry continues to strive for to increase the competitiveness in the market. One of them is through the implementation of industry 4.0. This is also in line with the government's program in responding to technological and information developments through the launch of Making Indonesia 4.0. The same thing was also done by PT. Tridharma Kencana (TDK), an electronic equipment assembly service (EMS) company that has been established since 2002. The idea of implementing industry 4.0 at PT. TDK was poured through a concept entitled Integrated Production System, as a roadmap for implementing industry 4.0 within the company. The research was conducted using a case study approach, which was an approach used to investigate and understand an event or problem that has occurred by collecting various kinds of information which was then processed to obtain a solution so that the problems revealed can be resolved, with an emphasis on a certain depth of analysis that was greater in-depth. The research subjects targeted in this research were; BOD, Production Department, Engineering Section, IT Section, Project Section, QC Section, Warehouse Section and Maintenance Section. The objects of this research were the stages of implementation, PIC, activities and programs, system integration, and the impact or results of the implementation of industry 4.0 in the company. Continuous improvement was a production methodology commonly used in many industries. No exception at PT. Tridharma Kencana, which had run through lean manufacturing and six sigma. The development of industry 4.0 also encouraged companies to implement it through the concept of the Integrated Production System (IPS). And the results were quite significant. This can be seen from several indicators that were used as measuring tools for implementation results, using five outcome indicators, namely productivity, downtime, NTF, scrap and use of labor. Where all indicators showed the positive results which lead to increased efficiency both in terms of cost and time, increased productivity or production output and increased industrial competitiveness. This was what then provided added value for the company so that it was better able to compete in the industrial world in Indonesia.

Keywords: Industrial Revolution 4.0, Efficiency,

INTRODUCTION

Indonesian President Joko Widodo has officially launched a roadmap for the implementation of Industry 4.0 to be implemented in Indonesia, known as Making Indonesia 4.0. This roadmap will serve as a foundation for Indonesia's economic growth in the future. The launch was carried out as part of a series of events at the 2018 Indonesia Industrial Summit in Jakarta, on Wednesday 4 April 2018.

Since then, the government through the Ministry of Industry has continued to massively promote the implementation of Making Indonesia 4.0, both through seminars and meeting agendas, as well as through supervision of industries, especially the manufacturing industry in Indonesia. Through Making Indonesia 4.0, the government has determined 5 (five) main sectors, namely; (1) food and beverage, (2) textile and clothing, (3) automotive, (4) chemical, and (5) electronics. The determination of the five sectors is carried out after evaluating and evaluating the criteria for the impact of the application of technology, such as contribution to GDP, market penetration, ability to absorb investment, and the potential impact on other sectors.

According to Kagermann et al (2013) the Industrial revolution 4.0 will and has introduced flexible mass production technology. In this context, productivity, efficiency and competitiveness become one of the important outputs of the successful implementation of Industry 4.0. Meanwhile, according to Sung (2017) in industry 4.0 production machines will operate and work independently or are able to independently coordinate with workers or humans.

Thus, it becomes clear that the industrial revolution 4.0 is an approach to control the production process by synchronizing time by unifying and adjusting production (Kohler & Weisz, 2016). Meanwhile, according to Zesulka et al (2016) in Muhammad Yahya (2018), it is stated that the industrial revolution 4.0 is used on three interrelated factors, namely (1) digitalization and economic interaction with simple techniques towards economic networks with complex techniques; (2) digitization of products and services; and (3) new market models.

When referring to previous industrial approaches and methodologies, such as productivity and efficiency methodologies in the industrial world, namely lean manufacturing and six sigma (a general approach that has been widely implemented in the industrial world in the world), when it is considered not adaptive again with technological developments that are running so fast. Call it the company's approach and strategy to get more value in front of its consumers in order to improve the quality of products and services produced by the company, such as through the implementation of the TQM (Total Quality Management) program and the implementation of ISO (International Standard Organization) 9001 on quality management, which incidentally is an important part and success factor of the implementation of lean manufacturing methodology. With the acceleration of information and information technology, it seems that it must be intensified and combined with the industrial revolution 4.0. So that productivity and efficiency are maintained from upstream to downstream of the industrial chain and production chain.

Because, after all, the industrial revolution 4.0 requires improving competitiveness through increasing productivity and efficiency by using technology as the key to success. The key successes include the Internet of Things, Artificial Intelligence, Human–Machine Interface, robotic and sensor technology, and 3D Printing technology. Industry 4.0 transformation in an industry is now something that must be done, in the midst of a massive free market. Otherwise, it is certain that national products and industries will not have competitiveness in the domestic and global markets.

As already mentioned above, that one of the main sectors to implement the industrial revolution 4.0 in Indonesia is the electronics sector. This is because the electronics industry sector currently still has a high dependence on foreign countries, both in terms of raw materials,

competence and knowledge of its human resources, innovations and breakthroughs in industrial technology, as well as the absence of simultaneous and comprehensive technology transfers. As a result, many electronics industries in Indonesia are still in assembly activities, with low added value.

Departing from the thought above, this research will conduct a study on PT. Tridharma Kencana, which is an electronic assembly service industry or Electronic Manufacturing Services (EMS) operating in Indonesia. PT. Tridharma Kencana, has been working on assembling electronic and telecommunication products, such as LED TV, Smartphone, Mify Modem, CPE, BBU, RRU and so on. And PT. Tridharma Kencana is one of the companies that has received supervision and assistance from the government through the Indonesian Ministry of Industry to implement and implement the Making Indonesia 4.0 roadmap. Thus, the selection of the object of PT. Tridharma Kencana in this study is quite appropriate, to see how far the implementation of industry 4.0 is able to have a significant impact on the productivity and efficiency of the company.

The formulation of the problem from this research is how to implement Making Industry 4.0 which is running at PT. Tridharma Kencana. The purpose of this research is to see and measure the extent to which the implementation of Making Industry 4.0 is able to contribute to increasing the productivity and efficiency of the company, so that it has an impact on increasing industrial competitiveness.

RESEARCH METHOD

The research was conducted using a descriptive qualitative approach. Descriptive research is a form of research aimed at describing existing phenomena, both natural phenomena and man-made phenomena. Qualitative approaches, which are methods for exploring and understanding the meanings that – by some individuals or groups of people – are ascribed to social or humanitarian problems. This qualitative research process involves important efforts, such as asking questions and procedures, collecting specific data from partisans, analyzing data inductively from specific themes to general themes, and interpreting the meaning of the data. The final report for this research has a flexible structure or framework. Anyone involved in this form of research must apply a research perspective that is inductive style, focusing on individual meaning and translating the complexity of a problem.

According to Martyn Hammersley (2005) in Brannen, qualitative research seeks to describe and explain perspectives and behavior at the same time, recognizing that behavior does not only flow from perspective and can also be inconsistent with it. Even such discrepancies are the main focus for qualitative research. Thus, this type of qualitative research can be used to research organizations, groups and individuals. In addition, this qualitative research has three main elements, namely; (1) data and data sources, (2) analysis and interpretation procedures and (3) written and oral reports.

On the other hand, J. Amos Hatch (2002) asserts that several characteristics of qualitative research, namely: (1) natural setting, (2) participant perspective, (3) researcher as data collection instrument, (4) extended first-hand engagement, (5) Centrality of meaning, (6) Wholeness and complexity, (7) Subjectivity, (8) Emergence of design, (9) Inductive data analysis, (10) Reflexivity.

Norman K. Denzin & Yvonna S. Lincoln (2009), emphasized that qualitative research emphasizes the socially constructed nature of reality, the close relationship between the researcher and the subject being studied, and the pressures of the situation that shape the investigation. Such researchers emphasize the value-laden nature of inquiry. This opinion is not an exaggeration because, according to Rossi and Freeman, in qualitative research the main instrument is the researcher, so it is not impossible to reveal the background of human behavior and experience from the frame of reference of the research subject (actor) itself.

The sampling of the research was carried out purposively because in qualitative research what would be sought was a natural problem so that not everyone could be sampled. Qualitative research also does not really need random sampling or random selection of participants or informants and research locations. Therefore, the discussion of informants or participants and research locations can cover four aspects: (1) research locations, (2) actors, (3) events and, (4) processes. If examined from this perspective, the research sample used as informants in this study consisted of several groups, namely: (1) Directors, (2) Heads of Departments; (3) Head of Division and; (4) Manager and Assistant Manager, (5) supervisor.

The limitation of the number of informants or samples as sources of data/information or research subjects is 20 people. This number is considered sufficient and is in line with the opinion of Emzir (2012), which researchers usually conduct 20-30 interviews based on several meetings in the field to collect data. This amount is also considered adequate because: (1) the information obtained from other informants is saturated or in other words only repeats what has been conveyed by previous informants and (2) the most important thing in qualitative research is not the number of people, but the depth.), the wealth (richness), and the complexity (complexity) of information owned by the informant. This is also in line with the process and technique of sampling iftar as presented by Strauss and Corbin (2003).

The primary data collection process used by researchers is the result of interviews with informants and field observations. Secondary data is company data given to researchers, books, journals and newspapers that can be used as references. Data collection, carried out through; (1) Interview. Interview technique is a technique of collecting data or information by meeting face to face with informants in order to obtain complete and in-depth data. This interview was conducted with high frequency (repeatedly) intensively (Sugiyono: 2011). Researchers will conduct semi-structured interviews, in order to get more open and in-depth ideas. Therefore, the researchers prepared interview guidelines. (2) Observation. Definition Field observations or field observations are activities that are carried out at any time, with the completeness of the five senses they have. Apart from reading newspapers, listening to the radio, watching television or talking to other people, observation is one of the activities to understand the environment. (Sugiyono: 2011). Researchers will make direct observations in the field where the research location is. The purpose of doing this observation is so that researchers can see firsthand the situation that occurs in the company's internal and external.

Data analysis techniques in qualitative research according to Creswell (2003) are carried out through the following steps: Step (1) processing and preparing data for analysis. Step (2) Read the entire data. Step (3) analyze in more detail by coding the data. Step (4) apply the coding process to describe the settings, people, categories and themes to be analyzed. Step (5) shows how these descriptions and themes will be restated in the qualitative narrative/report. Meanwhile, Miles and Huberman (1992) emphasized that there are three stages in data analysis, namely:

1. Data reduction

After the data is collected, the researcher selects the data according to the research focus. Data that is less relevant or less related to the research focus is reduced to make it easier to summarize and abstract the raw data, so that it becomes clear. This data reduction is a selection process, focusing on simplification, abstraction and transformation of raw data that emerges from data written in the field. Data reduction is a form of analysis that sharpens things that are important, removing things that are not relevant to the research focus so that they are systematic and meaningful.

2. Presenting data (Display Data)

Presentation of data is the process of delivering a number of information that has been compiled, which makes it possible to draw conclusions and take action. Data presentation is an overall picture of a group of data obtained so that it is easy to read as a whole:

At this stage the data can be presented in the form of narratives, matrices, graphs and discussed with various parties and sources. By presenting the data, the researcher can understand what is happening in the research, both regarding the validity of the data and the things that are lacking in the research.

3. Making conclusions (Conclusion drawing/ Verification)

At this stage the researcher draws conclusions and verifies and re-matches the data or field results or examines them with colleagues. Then it is processed so that it becomes data that is ready to be presented for further conclusions from the research results. The conclusion is a complete configuration. Furthermore, it was explained that this data analysis was carried out since data collection, meaning that you do not have to wait for all the data to be collected, but during the data collection process, data analysis can also be carried out.

RESULT AND DISCUSSION

The launch of the roadmap for the implementation of Industry 4.0 by the government was welcomed by PT. Tridharma Kencana, which incidentally is a mufacturing industry that uses technology and technological infrastructure to increase productivity, time and cost efficiency, so that it has high competitiveness in Indonesia. On the other hand, such tight market competition requires a variety of innovations and breakthroughs as part of continuous improvement to achieve efficiency and maximum economic value.

In this context, PT. Tridharma Kencana has implemented several industry methodologies, such as lean manufacturing and six sigma. However, along with the emergence of economic disruption, economic digitization, data and technology interfaces, big data, artificial intelligence, and other technological developments, it turns out to be running so fast when compared to the logic of efficiency and productivity in the industrial world. As a result, the steps of production innovation and continuous improvement that are implemented are felt to be left behind and run slower than the acceleration of the development of information technology. Moreover, as an industry engaged in electronics and telecommunications, PT. Tridharma Kencana is required to be able to use information technology as part of its core business and selling points.

On this basis, carrying out the Making Indonesia 4.0 roadmap initiated by the government is an alternative to accelerate efficiency, productivity and strengthen competition. Although many systems already exist and are implemented at PT. Tridharma Kencana, such as MES System, ERP System, Dashboard Intranet System, Ripair system, and data center as the center for technology and information control. However, all these systems are still running independently, or have not been integrated and work artificially intelligently.

Thus, several conditions are the background for the importance of increasing productivity and efficiency, as well as being the background for the importance of implementing industry 4.0 at PT. The Tridharma Kencana include:

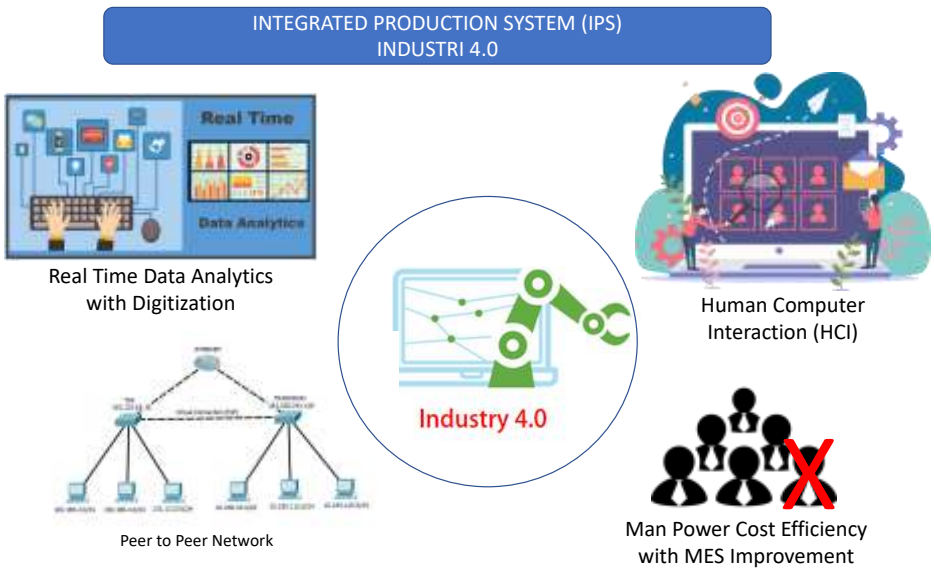
1. The Manufacture Electronic System (MES) already exists and is capable of being a medium of socialization, transparency and information media on issues in the production line, both issues for output data, not good goods (NG), downtime and so on. Thus the existence of the MES System is good enough to provide information and transparency to all people and employees, with real-time data support. However, unfortunately the MES System has not mobilized people/employees to increase awareness and ownership of issues in the production line. For example, when the target hours of UPH and UPPH are not achieved, they have not been able to mobilize employees to take improvement steps at that time. Even though the alert system is running, both with the color management system (Green, red, yellow). As a result, many KPIs were not achieved, especially KPI Downtime, FTY and NTF.

2. MES The new system performs data mining from station 1 assembly to the last station (Packing). While the data is WIP, Ripair and OQC, and has not been integrated with ERP. although there is information on the number of PO, raw materials and WO, but for these three things, input is still done manually. As a result, the use of human labor is still high for this process. As a result, it is difficult to achieve cost efficiency and UPPH KPIs.
3. MES The system also has not provided information on incoming material or raw material data (AQL targets) in the IQC process, because currently there is no system or software for digitizing IQC data based on AQL targets.
4. ERP system as part of the material and finished goods inventory system, is not yet connected to the MES System, causing the input of raw material availability to be done manually in the MES System.
5. The Intranet Dashboard, MES System, ERP, and CCTV Center are not yet integrated and connected, so employees are needed who specifically manage and run these systems, because all these systems work separately.
6. Intranet Dashboard, MES System, ERP are still placed as information and transparency, have not been able to change employee habits to care and be aware of issues that occur in real time. This means that awareness and ownership of issues in the field are still lacking or low. The impact is of course inefficiency, especially from time to time, because problem solving is not done quickly and on time.
7. This is due to the low awareness of employees to open the Intranet Dashboard, MES System through each PC/Laptop which is still low. As a result, not everyone and every time opens the intranet dashboard and MES System. Except specifically for the MES System whose display is installed in the meeting room, it is used as data and meeting material during the Daily Meeting (Every day at 8.30) and the daily review Plan (Every day at 14.30), so that the information automatically reaches all employees. The low awareness and responsibility for issues in the production line, has an impact on; NTF KPI target was not achieved, FTY KPI target was not achieved, Downtime KPI target was not achieved, UPPH KPI was not achieved, the number of failed products (NG). And all of that will have an impact on inefficiency in terms of cost and time.

Integrated Production System (IPS) Concept

The concept of implementing Making Indonesia 4.0 at PT. Tridharma Kencana is entitled Integrated Production System (IPS). Through this concept, the implementation roadmap is formulated and planned well. The IPS concept runs for 5 months, starting from August to December 2018. The IPS concept is as follows:

Figure 1: The Concept of Implementation of Industry 4.0 at PT. TDK



Source: PT. TDK : 2018

From the concept of the industry 4.0 roadmap entitled IPS, PT. Tridharma Kencana describes it into 4 main topics of discussion, namely (1) Program and timeline, (2) key factors and variables, (3) Risks and challenges in general, (4) results and benefits. These four things are described as follows:

1. Program and Timeline

Activity	PIC	Remark	Time
Training is given to the user, namely HC at the QC Dept	IT and QC Dept	This software is needed to complete data and information from the MES System	August 2018
Training pengunaan Sofware IQC baesd on AQL Target	IT and QC Dept	Traning is given to user i.e HC di QC Dept	August 2018
Integrasi Sofware IQC berbasis AQL Target ke dalam MES Sistem	IT Dept	Integration of AQL Target based IQC Software into MES System	Septem ber 2018
AQL Target based IQC software dissemination to all departments	HRD Dept	The HRD Dept socializes the AQL target-based Incoming Quity Control Software application to all departments	Septem ber 2018
MES System integration and connectivity, intranet Dasboard System attendance	IT Dept and FM	So that everything cn be integrated into a sinle unit of information and data as a basis for decision making	Oktobe r 2018
Increase capacity and ERP software modules (Upgrade)	IT	So that the existing ERP can be integrated with all existing systems	Oktobe r 2018

	Socialization of MES System, Daboard intranet, ERP which has been integrated and connected	IT, HRD Dept and FM	So that all departments and employees have the awareness to use this integration in all activities in each department	Oktober 2018
	Trial (Use Accepted Test / UAT)	All dept	Ensure the system runs well and there is no debugging	November 2018
	UAT Evaluation	IT Dept and FM	Ensure all systems are integrated and all employees can use them properly	Desember 2018

2. Key Factor and Variable

	Success Key Factor		
	Technology	1. Create AQL-based IQC awareness 2. Create your own ERP awareness 3. Develop awareness and connectivity between MES System, Intranet Dashboard, ERP, attendance system	1. The availability of software 2. lower downtime 3. lower NTF 4. Efficiency (Cost and time)
	People	1. The willingness of employees to pay from the old habit to the new habit 2. Upgrade employee competencies, both old employees and new employees	1. Changes in employee habits 2. Measurable employee competencies, to minimize the gap between old employees and new employees
	Awarness and Responsibility	Awareness and responsibility of all employees to all issues that occur	1. Perubahan habit karyawan 2. Kompetensi karyawan yang terukur, untuk meminimalisir adanya gap karyawan lama dan karyawan baru
	Awarness dan Responsibility	Kesadaran dan responsibility semua karyawan terhadap semua isu-isu yang terjadi	Increased awareness and responsibility of employees

Success Key Factor and PIC		
PIC	**Challange**	**Remark**
Top Management	1. Giving FM the authority to implement IPS in total 2. Encourage all departmental managers to implement IPS comprehensively	So that all employees are able to increase awareness and responsibility for IPS both including data, information, and accuracy and speed of problem solving
Midle Management	Socializing and implementing IPS in all activities in each department	Data, information and reports from all departments are integrated and have high accuracy
IT Dept	Creating IQC Software and integrating and connecting MES Systems, ERP, Intranet Dashboards, attendance systems	Make this activity a KPI for the IT Dept
All Dept	Changing Habits	Changing habits from initially only using the Intranet Dashboard and MES System as information only, turning into habits into data and analysis in making decisions and problem solving

3. Risks and Challenges in General
   a. At PT. Tridharma Kencana (TDK) is still developing the dichotomy between old employees and new employees. Existing employees are employees whose tenure is more than 15 years. Meanwhile, new employees are employees whose tenure is less than 15 years. As a result, it is always difficult for old employees to accept changes, including changes to using IoT and Big Data technology as part of productivity and efficiency indicators.
   b. Many employees are still dominantly using the data in the Dashboard and MES System only as information, have not used it as a data gap and analysis in making decisions. This means that the awareness to do this is still low.
   c. There is a fear of employees that if all systems are integrated and connected, there will be layoffs of employees, because many of their jobs are then replaced by machines and systems.

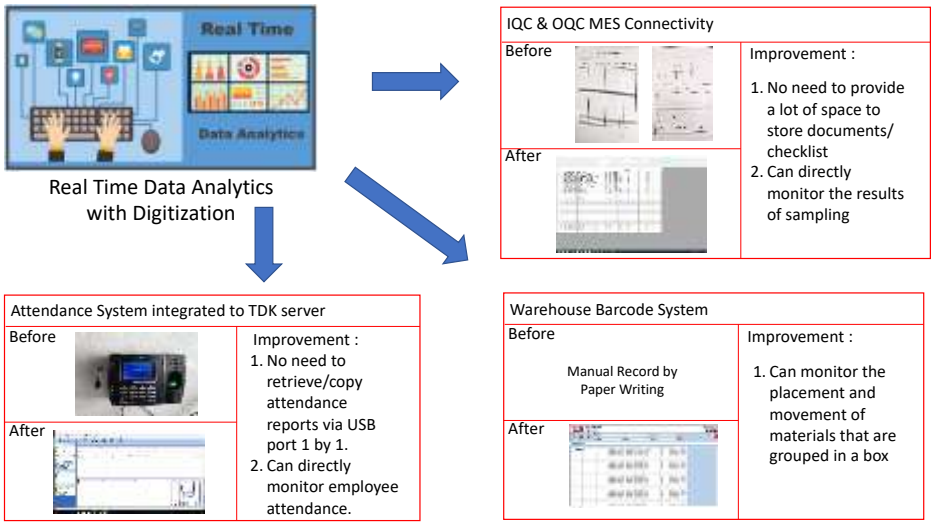
4. Result and Benefit
   a. Productivity and efficiency will be better, due to increased awareness and responsibility of employees, especially in terms of speed and accuracy in problem solving.

b. Building mutual awareness related to safety awareness, where security is a shared and all responsibility, not solely the responsibility of security.
c. Narrowing the competency gap and disparity between existing and new employees.
d. Achievement of specific target KPIs: Downtime below 5%, NTF below 5% and FTY above 96%.

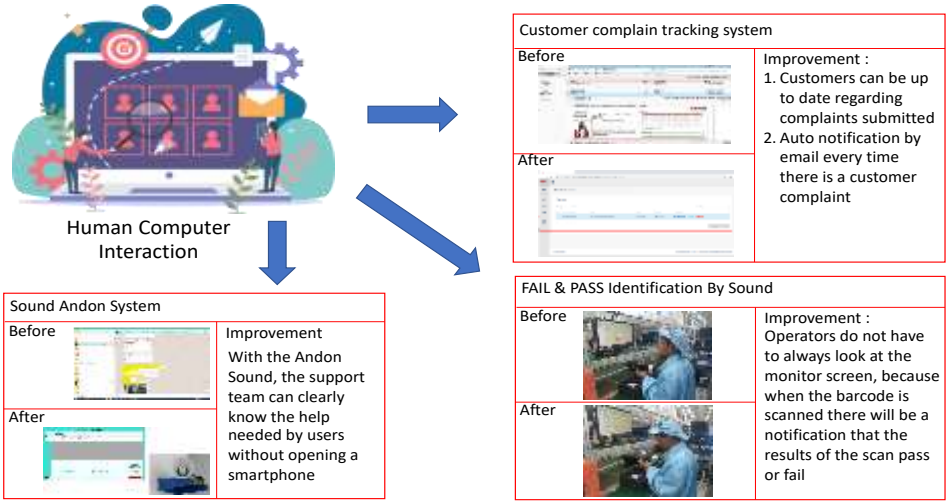
After and *Before* the Implementation of Industri 4.0

To see all program implementations, the researcher will describe the after (after) and before (before) implementation charts, as shown in the following pictures;

Figure 2: After and Before Realtime Data Analysis

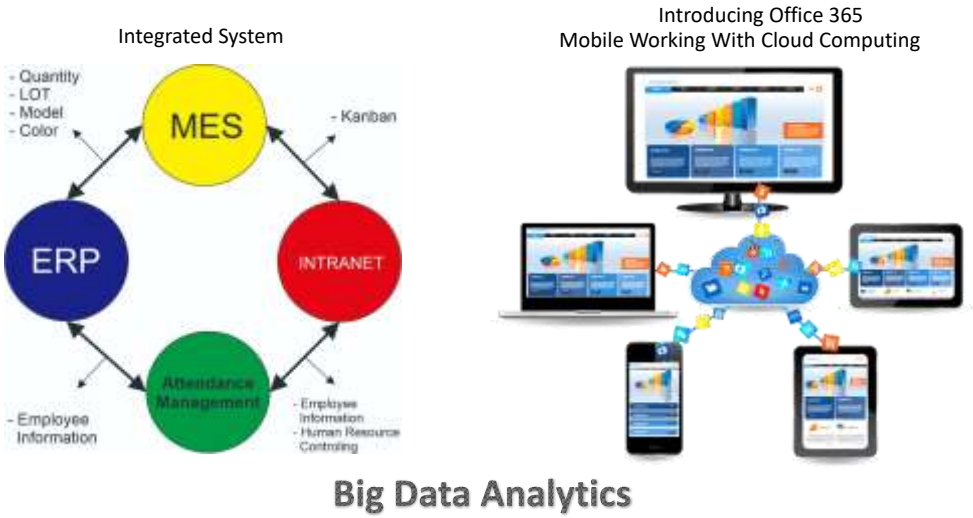


Source: PT. TDK ; 2018
Figure 3: After and Before HCI Implementation



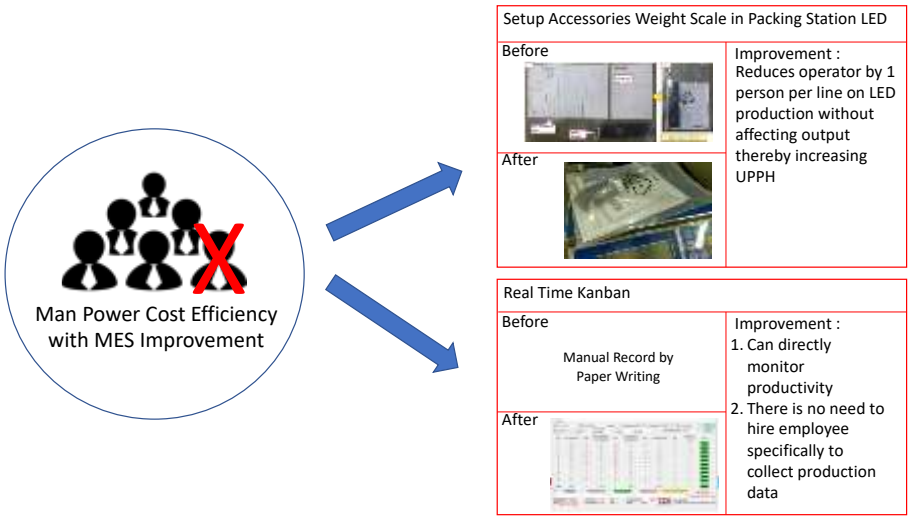
Source: PT. TDK ; 2018

Figure 4: After and Before Implementation of System Integration



Source: PT. TDK ; 2018

Figure 5: After and Before Implementation of Efficiency in Using People



Source: PT. TDK ; 2018

Based on the pictures above, starting from Figure 1 to Figure 5, it is clearly seen how the implementation of Industry 4.0 is running at PT. Tridharma Kencana. Both regarding the actual conditions before implementation and the actual conditions after implementation. The above illustrates that the concept of implementing Industry 4.0 at PT. Tridharma Kencana is planned quite comprehensively, both in terms of control, supervision, socialization and implementation in all lines and departments within the company.

The Results of the Implementation of Industri 4.0

A major change in the industrial world order has occurred again, which is marked by the application of the Industrial Revolution 4.0. In this era, the industrial world is marked by the massive use of information technology as the main tool to increase productivity, efficiency and value added industry. That is, how a factory or manufacturing industry can produce goods and services in large quantities but with time and energy efficiency. For this reason, programming or software based on technology is used in the production process. Changes in the industrial world are recognized as having both positive and negative impacts.

There are various consequences that must be accepted by humans, both industrialists and the general public. The shift in this era does not only apply to the practice of production, distribution, and consumption of food and services but also to fundamental changes such as the way of life of individuals and social strata (Janikova & Kowalikova, 2017). This shift began in the second decade of the 21st century which was marked by the transformation of various fields, including lifestyle, work, way of thinking, and others. Even today, digital technology is present and has a massive systemic impact in all aspects of human life, both in the economic, social, political, and even educational fields. This is what became known as the digital economy platform.

In the economic field, we can feel the changes since the proliferation of e-commerce or electronic commerce, such as Bukalapak, Traveloka, Lazada, Elevania, and others. The emergence of these various startups makes it easy for people to shop for their needs without having to come to department stores or shops. In addition, the transportation industry has also

experienced drastic changes and can be said to have experienced economic disruption. Conventional modes of transportation are shifting to digital transportation platforms. Call it uber, gojek, grab and so on, all of which are available online or online. Gojek, grab, and uber are some of the modes of transportation that are now dominant throughout the world, although at the beginning of their emergence they received a lot of opposition from conventional and traditional transportation businesses.

The World Economic Forum (WEF) states that the industrial revolution 4.0 is marked by the fusion of technology that is able to erase the boundaries of driving economic activity, both from a physical, digital, and biological perspective. In simpler language, it can be said that the blending of technology is able to integrate human resource factors, production instruments, and operational methods, in achieving goals. The characteristics of the industrial revolution 4.0 are marked by various applied technologies, such as advanced robotics, artificial intelligence, internet of things, virtual and augmented reality, additive manufacturing, and distributed manufacturing which as a whole are able to change the pattern of production activities starting from the supply chain, standard quality control, inventory and able to change business patterns and business models in various industrial sectors. Through the application of modern technology, the industrial sector is no longer solely focused on business development and increasing profits, but also on the utilization and optimization of every activity, from capital procurement, production processes, to services to consumers. (WEF : 2017)

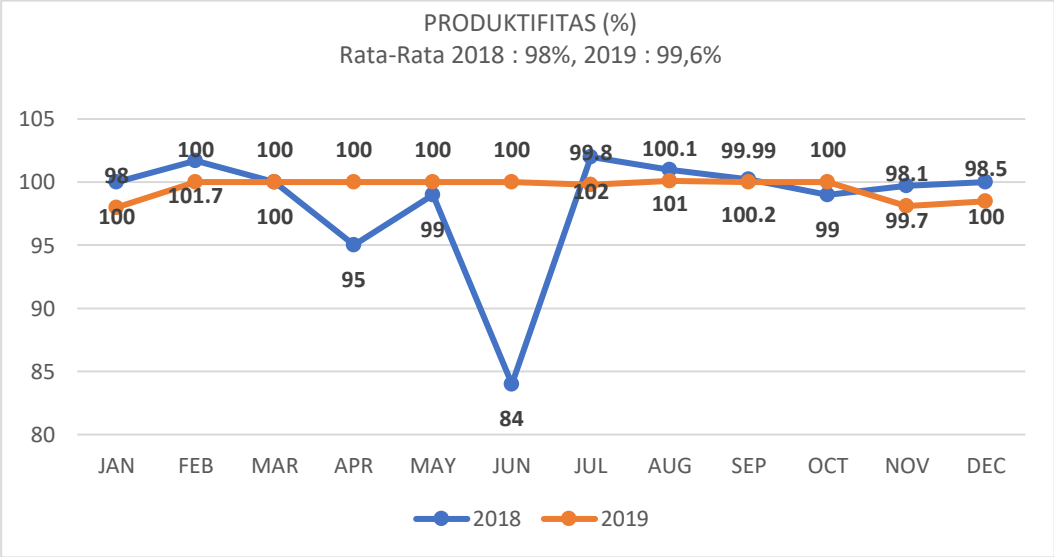
In this context, PT. Tridharma Kencana also made significant changes in the context of the implementation of Industry 4.0, which was then referred to as IPS as described above comprehensively, starting from the formulation of concepts, program activities, PIC, time line, to the goals or objectives to be achieved.

To see whether the implementation has an impact on productivity, efficiency and added value, it must be seen through several indicators and indicators of the results of the implementation of Industry 4.0 by comparing 2018 (before the implementation of Industry 4.0) with 2019 (after implementing Industry 4.0), which will be discussed as follows:

1. Productivity

   Productivity in this context is the result or output of production, using the output parameters generated from the production line compared to the production plan or plan. The higher the productivity, it means that the results or production output are getting better.

Figure 6: Productivity in 2018 and 2019



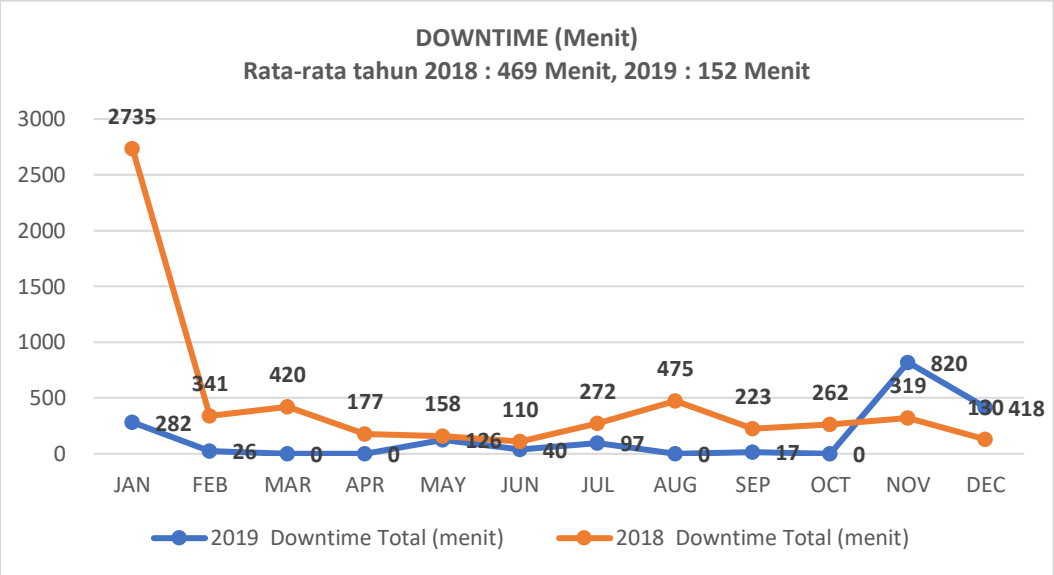
Source: PT. TDK ; 2018

Based on the picture above, it is known that throughout 2018 before the application of industry 4.0 the average productivity at PT. Tridharma Kencana is 98%, and in 2019 after implementing industry 4.0 its productivity was 99.6%. This means that with the implementation of industry 4.0 there is an increase in productivity of 1.6% compared to 2018.

2. Downtime

Downtime is the time lost due to an issue or disruption in the production line. Whether it's caused by machines, humans, electricity, materials or raw materials, technology or other disturbances that cause production time to be reduced. The higher the downtime, the higher the disruption or issues in the production line, and this of course has an impact on decreased productivity.

Figure 7 : Downtime in 2018 and 2019



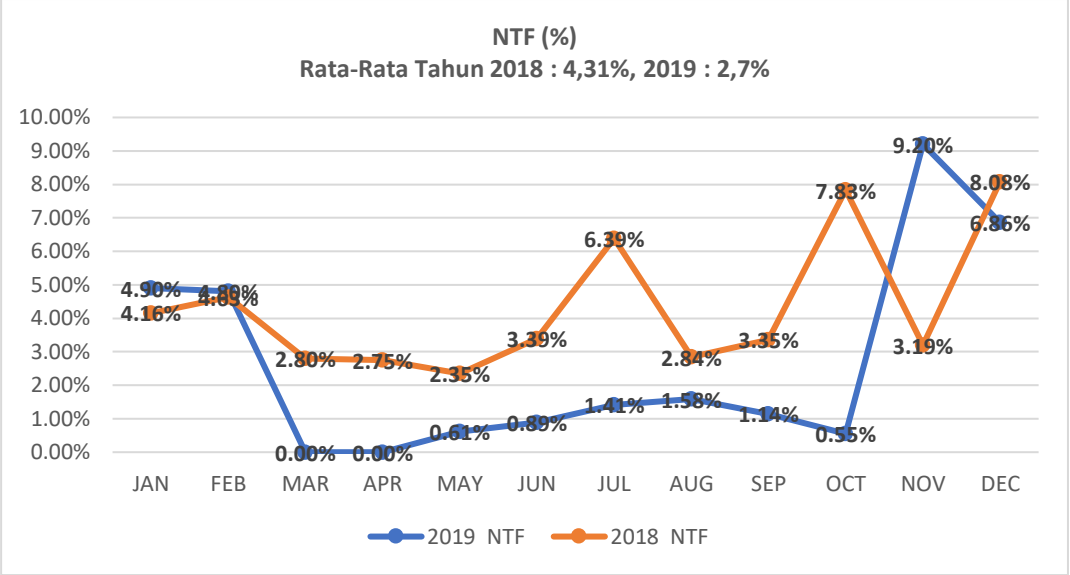
Source: PT. TDK ; 2018

Based on the image above, it is known that the average downtime throughout 2018 was 469 minutes. This means that every month there are disturbances or issues in the production line, an average of 469 minutes. With a total working time of a month is
10,080 minutes, meaning that throughout 2018 each month the downtime was 469 minutes or 4.7% of the total working time for one month. Meanwhile, throughout 2019, the average downtime was 152 minutes. This means that with a month's working time of 10,080 minutes, the downtime that occurs is 152 minutes or 1.5% of the total annoying time. Thus, through the implementation of industry 4.0 at PT. Tridharma Kencana has reduced downtime by 317 minutes or decreased downtime by 3.2% per month. This means that the implementation of industry 4.0 has encouraged increased efficiency in terms of time.

3. No Trouble Found (NTP)

No Trouble Found (NTF) is a disturbance or issue that occurs in the production line originating from machinery and technology. The larger the NTF, the higher the number of disturbances or issues and of course the impact on productivity and output.

Figure 8 : NTF 2018 and 2019



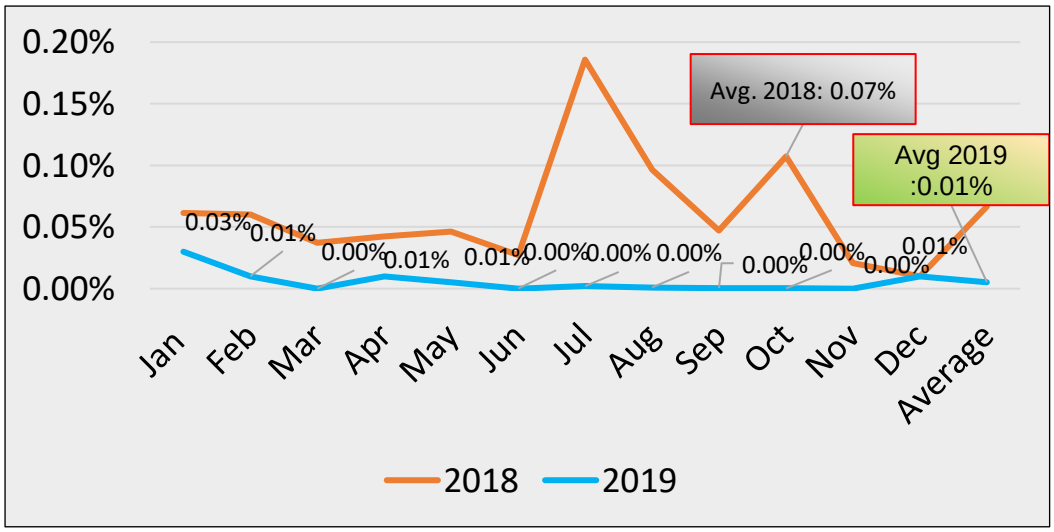
Source: PT. TDK ; 2018

Based on the figure above, it is known that throughout 2018 the average monthly disruption or issue in the production line sourced from machines and technology was 4.31%. And after the implementation of industry 4.0 there was a decrease in NTF to 2.7%. This means that the implementation of industry 4.0 has an impact on reducing interference from machines and technology by 1.61%. This is of course a pretty good result, moreover, one of the focuses of industry 4.0 is on the aspect of using technology, so that technology is able to encourage efficiency in terms of time which is marked by a decrease in interference caused by machine and technology factors.

4. Scrap

Scrap is material or raw materials that become waste due to a defect rate or an error in the production process. This error can be caused by humans, technology, machines and so on. The larger the scrap, the more errors occur, causing a lot of defects due to the production process (production defect rate).

Figure 8 : Scrap 2018 and 2019



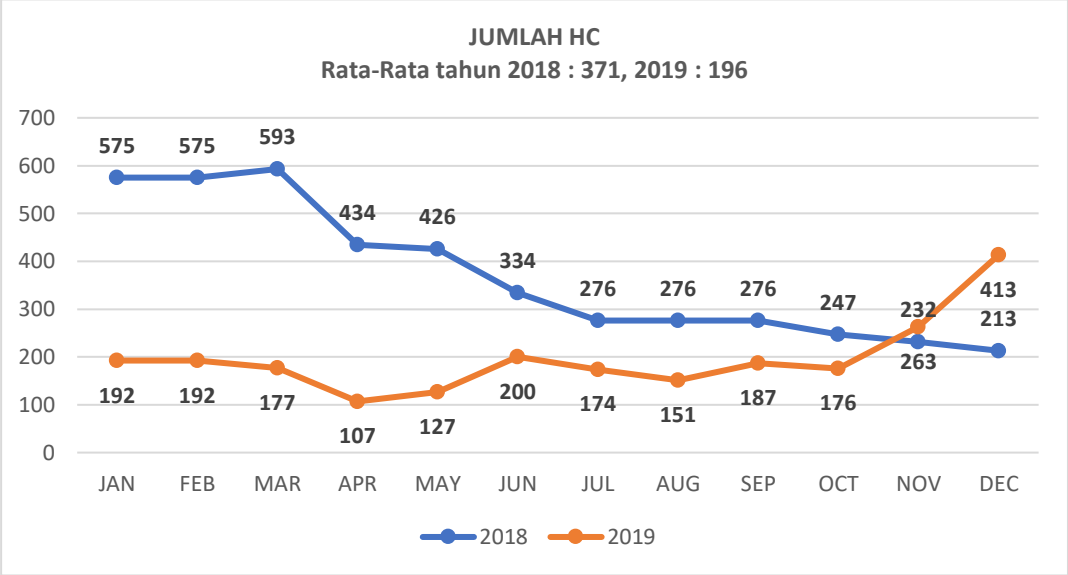
Source : PT. TDK ; 2018 dan 2019

Based on the figure above, it is known that the average scrap throughout 2018 was 0.07%. And after the implementation of industry 4.0, it turned out to be able to reduce scrap to 0.01% or decreased by 0.06%. This means that the implementation of industry 4.0 has increased efficiency in terms of production impact by 0.06% every month throughout 2019.

5. Use of the Number of Employees (Head Count)

As has become the concern of many circles, that the implementation of the 4.0 industrial revolution will have an impact on reducing the number of workers, because they are replaced by machines, robots and systems. This is of course a consequence for the industrial world as a way to increase efficiency, but still maintain productivity.

Figure 10 : Number of HC in 2018 and 2019



Source: PT. TDK 2018 dan 2019

Based on the picture above, it is known that the average monthly use of labor throughout 2018 at PT. Tridharma Kencana is 371 people (HC). And after the implementation of industry 4.0 through the use of machines, robots and systems, it turned out to have reduced the use of labor by 196 per month throughout 2019. This means that with industry 4.0 there has been a reduction in the use of labor by 175 workers, or a decrease of 47%. This is certainly a very significant efficiency achievement along with the implementation of industry 4.0 at PT. Tridharma Kencana.

Based on the description above, the implementation of Industry 4.0 at PT. Tridharma Kencana through the concept of Integrated Production System (IPS) turned out to provide significant results or impacts to increase productivity, efficiency and added value for the industry. This is clearly illustrated by several indicators that are used as measuring tools for implementation results, using five outcome indicators, namely productivity, downtime, NTF, scrap and use of labor.

Such facts, answer and strengthen several theories and opinions of experts such as Kagermann, Sung, Kohler & Weisz, which in essence the use of technology, robots, digital platforms, applications or software will encourage a shift in production patterns and methodologies in a manufacturing industry which leads to increased efficiency both in terms of cost and time and increased productivity or production output.

CONCLUSION AND RECOMMENDATION

Conclusion

The Industrial Revolution 4.0 has emerged as a production methodology in the manufacturing industry. No exception at PT. Tridharma Kencana which incidentally is an electronic equipment assembly industry and telecommunications assembly service company (EMS) in Indonesia.

Since it was launched by President Jokowi through Making Indonesia 4.0 in April 2018, PT. Tridharma Kencana also implements Industry 4.0 through a concept called the Integrated Production System (IPS). This concept is designed comprehensively. Both in terms of the stages of activities and programs, PIC, integration methods, knowledge transfer, technology transfer and everything is prepared for 5 (five) months, from August to December 2018. And implemented starting in January 2019.

Throughout 2019, which was the first year of the implementation of industry 4.0, several parameters of the results or impacts of the implementation of industry 4.0 turned out to be quite significant. Where from the five indicators of results or impacts, which consist of productivity, downtime, NTF, scrap and the use of the number of employees, all of them give positive or significant results.

Thus, it can be said that the implementation of industry 4.0 at PT. Tridharma Kencana runs quite well and is able to provide results in increasing cost efficiency, time efficiency, and increasing productivity. Where everything will certainly lead to increased competitiveness and added value of the industry.

Suggestion

The conclusion of this study has shown the positive impact of the application of industry 4.0 on the efficiency, productivity, competitiveness and added value of the industry. However, so that the discussion and point of view are more comprehensive, it is necessary to conduct further research on the impact of implementing industry 4.0 from a financial point of view, so that it can be known with certainty how much efficiency is financially, and an increase in financial productivity. This is important to see further whether the implementation of industry 4.0 is able to increase company profits or not.

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