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INDUSTRIAL 4.0 APPLICATION IN INDONESIAN HOSPITAL: A CASE STUDY

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Abstract: *The industrial revolution of 4.0 drives technological innovation in terms of production and services to provide fundamental disruption or change to people's lives. It also presents a challenge for the industrial world, including the hospital industry. Hospital management supports to make changes in all areas to respond to the future needs of hospital customers. This research is a case study discussing the Indonesian hospital in Yogyakarta. The research method is a descriptive analysis that discusses the activities and processes at the Indonesian hospital by looking at the perspectives of several references and then evaluating them. The data are obtained from respondents who have several times a reference and experience of the service system. This research reveals that the application of industry 4.0 in hospitals in Yogyakarta is expected to be used as a reference for other hospitals in Indonesia, especially in terms of the service system.*

Keywords: *Industry 4.0, Hospital, Service*

1. INTRODUCTION

We have now entered industry 4.0, which applies the concept of automation to make time, energy, and cost-effective. With the help of the internet, on-time exchange or data retrieval can be done. The 4.0 industrial revolution is the development of the 3.0 industrial revolution which is the starting point of the digital revolution era, which combines innovations in the fields of electronics and information technology [1] New innovations in Industry 4.0 include: Internet of Things (IoT), Big Data, 3D printing, Artificial Intelligence (AI), self-driving vehicles, genetic engineering, robots, smart machines, and others.

Some have their own version 4.0, such as industry 4.0 (Germany), smart manufacturing (America), industrie du future (France), high-value manufacturing (UK), fabbrica del future (Italy), and society 5.0 (Japan) [4][7]. From various terms from various countries, there is no agreement related to the term 4.0. Meanwhile, Indonesia is now slowly beginning to follow the industrial revolution of 4.0 [6].

In Indonesia, there is a reference standard to measure the level of readiness of companies to transform into the industrial era 4.0, namely the Indonesia Industry 4.0 Readiness Index (INDI 4.0). INDI 4.0 has five pillars that can be measured their readiness level (initial, medium, mature, and already prepared). These pillars include management and organization, organization and culture, products and services, technology, and factory operations [2]. At the factory, the application of the industrial revolution 4.0 can be known as a smart factory. The production and bookkeeping process at the factory can be driven automatically through the help of the internet. In addition to manufacturing, Industry 4.0 is also applied in the health sector. In the medical field, Industry 4.0 seems to provide extensive applications for the

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creation of customized implants, tools, and devices. This revolution provides a better way of using information, manufacturing, and services to provide improved quality of life [3]. The industrial revolution 4.0 is driving technological innovation in terms of production and services that have a fundamental disruption or change impact on people's lives. This will provide challenges for the industrial world, including the hospital industry. Hospital management is encouraged to make changes and innovations in all fields to respond to the demands and needs of hospital consumers in the future.

In facing the Industrial 4.0 era, the Association of Indonesian Hospitals (PERSI) has conducted training for Hospitals in Indonesia so that they can prepare themselves [9]. Industry 4.0, according to PERSI includes virtual reality, artificial intelligence, cloud computing, big data analysis, and the internet of things. Some things that must be prepared by the hospital in facing Industry 4.0 include service quality and risk management, hospital information systems, hospital facility management, hospital law and ethics, lean management, and hospital technology. There are several types of hospitals in Indonesia, namely Type A, B, C, D, and E. Type A is a hospital that is able to provide specialist medical services and extensive sub-specialists by the government, this hospital has been designated as the highest referral service place (top referral hospital) or also called a central hospital. Hospitals in Indonesia consist of public hospitals and private hospitals with a total of 2,773. The growth of public hospitals over the past six years is not as fast as the growth of private hospitals. One of the private hospitals in Indonesia with Type A is XYZ Hospital, located in Yogyakarta, Indonesia. Concerning the application of industry 4.0 in the health sector from the literature review, this paper discusses and evaluates XYZ hospitals in Indonesia, particularly in the case of managing outpatients.

2. METHODS

This research method is descriptive, analytic, and qualitative, and is complemented by literature studies and observations of the application of industry 4.0 in the health sector, especially Hospital XYZ. The main points discussed in this study are the activities and processes at the XYZ Hospital in the framework of industry 4.0 or Indonesia 4.0 by looking at the perspectives from several references, identifying challenges, and analyzing the application at the XYZ Hospital then evaluating them. As a first step, the process of managing outpatients needs to be identified in order to run the outpatient services business process at the XYZ Hospital, one of which aims to improve services to patients. The research continued with the study of literature about challenges in facing industry 4.0. The criterion in the literature study is conformity with the business process of Hospital XYZ as a hospital that has implemented Industry 4.0 by using the internet of things.

At the end of the study, an analysis was carried out related to the application of Industry 4.0 at the XYZ Hospital. From the analysis, it can be identified as the steps for improvement based on the health framework and INDI 4.0 so that it can be used as a reference for hospitals in Indonesia that will implement Industry 4.0 in the scope of the outpatient service business process.

3. RESULTS AND DISCUSSION

3.1 Industry 4.0 in the Health Sector

There is no agreement on the term 4.0 [7], but everyone agrees that industry 4.0 in Indonesia is one of the countries that is moving towards an industrial 4.0 revolution. According to [6], the future of production capabilities needed in dealing with industry 4.0 includes demand environment, technology and innovation, institutional frameworks, global trade and investment, human capital, sustainable resources, scale, and complexity.

Industry 4.0 caused significant changes in the industrial sector especially in Europe, the United States, and several countries in Asia (Pachini et al., 2019). Industry 4.0 is a set of 'disruptive' digital and physical technologies that offer new values and services to customers and organizations. In this study, we propose a model to measure the level of readiness of manufacturing organizations related to the application of Industry 4.0. Several models have been proposed in the past to determine the level of company maturity that measures the progress made by companies in the application of Industry 4.0. However, there is no proposed model that determines the level of preparedness of the company, which is the first step in the maturation process. To develop the model proposed in this study, we use a structure based on the Society of Automotive Engineers (SAE) J4000 standard to measure the implementation of lean manufacturing in a company; the model was modified to encompass the principles and concepts of Industry 4.0. The proposed model consists of eight possible most relevant technologies based on the existing literature. Real-world use of the proposed model was tested by an auto parts manufacturing company in Brazil.

Industry 4.0 is considered the fourth industrial revolution that introduces a new paradigm with digital control, autonomy, and decentralization in manufacturing systems (Sahal et al., 2020). The two main objectives of the Industry 4.0 application are to guarantee maximum uptime on the entire production chain and to increase productivity while reducing production costs. As data-driven (data support) develops, companies have begun using Big Data Techniques to achieve goals. Big Data and IoT technologies play an important role in building data-oriented applications such as predictive maintenance.

Industry 4.0 and other synonyms such as Smart Manufacturing, Smart Production, or the Internet of Things, have been identified as major contributors in the context of digital and automated manufacturing environments (Kamble et al., 2018). The term industry 4.0 consists of various technologies to enable the development of binding values, which results in lower manufacturing grace periods, and improvements in product quality and organizational performance. Industry 4.0 has attracted a lot of attention in the recent literature, however, there are very few systematic and extensive reviews of research that capture the dynamic nature of this topic. Rapidly growing interest from academics and practitioners in Industry 4.0 has urged the need for a review of the latest research and development to develop a new agenda.

Even Haleem and Javaid (2019) call the current era an industrial era 5.0. Industry 5.0 is known as the fifth industrial revolution where personalized customer needs can be met. Today, customers focus on personalizing products that have unique and special requirements. Previously, Industry 4.0 activated mass customization, which was not enough. Now, customers want mass personalization to have a human touch, so Industry 5.0 makes them move from mass customization to mass personalization. It provides products to customers as per their specific requirements. This industrial revolution refers to the interaction between people and machines to make work better and faster. There is a large contribution of robots doing work loading, disassembly, painting, welding, etc. Industry 5.0 has interconnected machines that optimize human productivity and efficiency. The journey of the industrial revolution has begun which has great potential to match what the customer wants. There is a big improvement in quality, safety, and waste reduction.

In the medical field, it will also introduce four-dimensional computed tomography (4D CT) and four-dimensional magnetic resonance imaging (4D MRI) to provide better information about parts of the body with certain movements. These techniques are quite useful for manufacturing smart medical components using 4D printing. This scanning technique is quite fast and accurate automatically tracks and analyses internal body movements. Can meet the requirements of smart materials where medical parts are produced and can subsequently change shape and grow into the human body. It applies to the manufacturing of intelligent, complex organs, cells, muscles, heart, kidneys, liver, skin grafts, and tissues meeting unique requirements.

The medical profession is working towards personalization, which has device requirements that can meet personal needs, such as measuring blood sugar, blood pressure, and other body parameters. (Haleem and Javaid, 2019). The technology can be used to provide doctors with patient real-time health information. The data can be entered into individual medical records, helping to extract data for individual patients and groups. Smart devices can communicate among themselves, and doctors can provide the right treatment according to the individual needs of patients.

In health care, this revolution provides patient-centric health care to provide a better quality of life (Haleem and Javaid, 2019). It has an excellent ability to provide information for the manufacture of personalized implants, tools, and devices. Digitally monitor all activities regarding health through the integration of digital design, manufacturing, and information technology with supporting software. There is no doubt that the pace of this revolution will increase. This emerging revolution will be a combination of big data, artificial intelligence, special software, machine learning, and intelligent algorithms that are connected to the Internet to change everything.

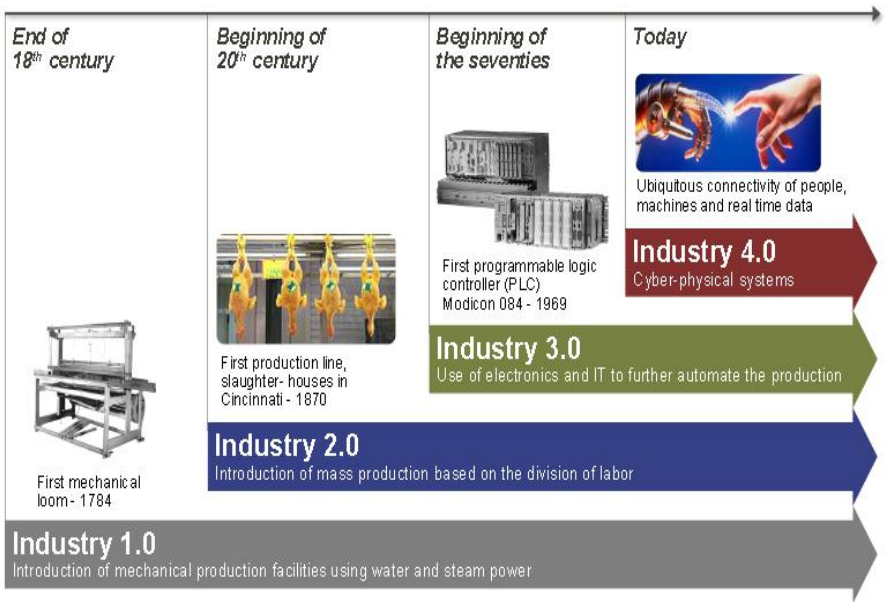

Fig 1. Future of Production Capabilities [6]

Industry 4.0 performs various functions and profits among all the previous revolutions because it solves various medical problems with the interdisciplinary approach. Industry 4.0 performs the following functions when adopted in the medical field, including maximizing productivity; analyze data of the patient which is helpful for different medical technologies; digitally store medical data and provide awareness about the next level of diseases; increase accuracy; reduce time and cost; improve quality; reduce inventory by storing patient data in the digital computed aided design (CAD) file; reduce paperwork; improve material management; improve tooling management; efficiently manufacture customized implants as per patient match using sensor-based smart components; apply right control processes for complex surgeries; by the applications of sensor system and digital technologies, it can automatically track new diseases; create a centralized information system in the hospital; detect data of the patient and determine relative information [1].

Industry 4.0 helps to create digitization in the medical field with the help of different technologies [3]. These technologies provide safety, satisfaction, and better information to the patient. Different technologies of Industry 4.0 for medical field are discussed in the following paragraphs:

- Additive manufacturing

Additive manufacturing is a disruptive innovation that is helpful in the medical field. It uses a set of 3D printing, 3D scanning technologies, and associated designing and scanning software. It manufactures any medical/other physical parts layer by layer from 3D CAD data. In the medical field, this is the most successful technology because of its flexibility in design and manufacturing. It manufactures exact patient-specific implants, tools, and specific devices as per requirement.

- Robotic

Robots are used to perform surgery and provide improved performance, movement, and control. Now, surgery can be performed through computer control. It reduces/eliminates tissue trauma in an open-heart surgery case. It can also work in an environment that is felt dangerous for surgeons.

- Holography

Holography is a non-contact 3D imaging that can be seen by a naked eye. It provides details of the human anatomy, tissue, bones, and activity of an internal organ of the body with high resolution. Doctors can now see the patient in a holographic image without the physical presence of the patient. It is an excellent tool for contactless study, which is used to measure the internal and external fracture. Holography has excellent potential to addresses the challenge of storing the complex issue of 3D image storing of the patient. Patient diseases/other information can be stored digitally, which can be helpful to train medical students.

- Sensors

In the medical field, pressure sensors and mass flow sensors are used to provide a solution as per the requirement of surgery. Sensors provide information about temperature, blood pressure, and other conditions of the patient. Different types of sensors are used as per the requirement of the medical field.

- Internet of things (IoT)

IoT has opened up a world of possibilities in medicine. It connects the Internet and medical devices and collects valuable information to provide control over patients' lives and treatment. It is helpful in monitoring, treatment, and testing to provide satisfaction to the patient.

- Big data

In health care, big data provides life-saving outcomes. By the digitization, it referred to vast quantities of information and analyzed it. Doctors required an understanding of patients' past for their best treatment, so this technology is helpful to provide valuable information regarding patients such as the sign of illness. It also provides relevant critical insights into better care and faster treatments.

- Artificial intelligence

In the medical field, AI is used to analyze complex medical data. It is an essential technology that is programmed and controlled by machines with the help of the computer. It has the ability to gain information and well-defined output for doctors and patients. AI provides prevention and treatment techniques to improve patient outcomes. It is helpful in personalized medicine, diagnosis processes, disease level, drug development, and patient monitoring.

In the current Internet era, the Health Industry has grown from generation 1.0 to 4.0 (Kumari et al., 2018). Healthcare 3.0 is a centric hospital, where patients with long-standing illness suffer from multiple hospital visits for their routine check-ups. This in turn, extends the

patient's care along with an increase in overall expenditure on patient care. However, with recent technological advances such as fog computing and cloud computing, this problem has been overcome by minimum capital investment in computing and storage facilities related to patient data. Various obstacles drive the digital transformation of the biopharmaceutical industry (Ding, 2018). The new digital technique, often marketed as 'Pharma 4.0', is considered to be able to overcome some of the obstacles that have long existed in the biopharma life cycle. Pharma 4.0 concepts, such as cyber-physical systems and dark factories, require data science tools as a core component of technology.

Technology exploitation arising from the Pharmaceutical Industry 4.0 facilitates sustainable value creation, leading to a more agile, intelligent and personal pharmaceutical industry (Steinwandter et al., 2019). Thus, in the long run, it allows pharmaceutical companies to gain competitive advantage. Pharmaceutical supply chains need to be implemented to match / adjust between future operations and management of pharmaceutical products that cover the entire life cycle.

In the era of Industry 4.0, the physical world was transformed into digital and connected with each other. The explosion of smart devices and technology enables communication anywhere and anytime (Munirathiman, 2019). Industry 4.0 focuses on interconnectivity, automation, autonomy, machine learning, and real time data. The first challenge of IoT is security and privacy. Decision making can quickly increase revenue, productivity, and efficiency. AI in health care has focused on reducing costs (always a requirement) and improving patient outcomes with AI, such as: finding patterns for better diagnosis and identifying new treatments. AI technology currently focuses on applying in-depth learning algorithms to detect and highlight abnormalities in medical imaging. AI also helps chatbots patients to schedule appointments, make billing more efficient, or be transparent in providing basic medical information. Precision in determining the drug by diagnosing the disease through a machine using AI trends and determining treatment plans; understanding related genomics and predicting the likelihood of successful treatment; and finally enlarge the right treatment and monitor it.

In recent years, there has been an exponential increase in the use of Healthcare 4.0 based diagnostic systems worldwide (Hathaliya et al, 2019). In health services 4.0, patient records are stored in electronic health records (EHR) repositories that can be placed, either in a centralized or distributed location to help doctors easily access patient health data from anywhere at any time. Because this data is accessed from a database repository using open channels, such as the Internet, security and privacy are the main concerns when accessing it from any location.

The internet is everything and big data made by intelligence provides accurate information in health care (Haleem and Javaid, 2019). Electronic medical records (EMR) are digital versions of graph paper in clinics, clinical offices, and hospitals. They pay attention and provide information to health professionals during diagnosis and treatment. Another technology is Google Glass which is used by several doctors in consultation with patients while the clerk does type work.

The ability to predict the patient's EMR information through the risk warning system has an important reference value in clinical nursing, which can significantly reduce the nurse's risk

of infusion, surgical patient handover, and blood sample collection (Peng et al., 2019). It also can improve the quality and efficiency at diagnosis and at hospitals.

Big Data has the characteristics of heterogeneous and constant growth, which requires a non-standard approach to storing and processing data (Shakhovska et al, 2019 (a)). Development of a patient information trace model based on personal data and patient medical data. Personal data in decision making consists of steps: step formation ontology of medical process knowledge and steps to formulate the process of finding a standard solution. A personal approach to standard schemes is proposed by modifying decision-making methods based on decision trees, taking into account the relationship between patient parameters. The results of this method are presented in the p scheme.

Over the past decade, there has been increased interest in research on big data, especially for health service applications (Elhoseny et al., 2018). Adoption of the cloud computing paradigm and the Internet of Things (IoT) in the field of health care can bring several opportunities to medical IT and experts believe that the field can significantly improve health services and contribute to continuous and systematic innovation in a big data environment, such as Industry 4.0 application. However, the resources needed to manage that data in a cloud-IoT environment are still a big challenge. Therefore, this paper proposes a new model for optimizing the selection of virtual machines (VMs) in cloud-IoT health service applications to efficiently manage large amounts of data in integrated industry 4.0. Industry 4.0 applications need to process and analyse big data, coming from various sources such as sensor data, without human intervention. The model aims to improve the performance of the health care system by reducing the execution time of stakeholder requests, optimizing the storage of patient big data needed, and providing real-time data retrieval mechanisms for the application. The proposed hybrid cloud-IoT architecture consists of four main components: stakeholder devices, stakeholder requests (tasks), cloud brokers and network administrators. To optimize the selection of VMs, three different well-known optimizers (Genetic Algorithm (GA), Particle swarm optimizer (PSO) and Parallel Particle swarm optimization (PPSO) are used to construct the proposed model. To calculate the time of implementing stakeholder requests, the proposed fitness function is a composition of three important criteria namely CPU utilization, play time and waiting time.

To solve problems in the search for medical information one can use the semantic search method (Shakhovska et al, 2019 (a)). Complex solutions are needed for monitoring, filtering, compiling, and searching link / hierarchical relationships. Very large variables can be observed using Big Data. Analysis and verification of personal data based on the analysis of user information on online medical services is part of the systematic verification method of personal data and patient medical data. The data is in the online medical system. Track information based on the contents of patient information, which includes personal information, health profiles (diagnosis, history, and treatment), medical community and health interests, user desks, and health feeds. Shakhovska (2019 (b)) has made modelling and developing a mobile system for medical recommendations.

In experiments in scientific discovery, the selection of features is a definite initial part (Wieslaw, 2019). This approach is specific to the application of tree classification algorithms

to estimate the importance of attributes extracted from a tree / tree structure with repeated applications in generational feature selection. The method implements the removal of selected features from the dataset and then forms the next generation of important feature sets. The process occurs until the most important feature becomes a random value. The method applied has been applied to three artificial medical datasets and the actual dataset. The selection and classification results are also presented in this paper. As a result, after a selection is made, the feature set is far more efficient than using the original feature set.

Advances in sensor systems, automation, and Information and Communication Technology (ICT) / manufacturing and information technology for manufacturing open new opportunities for lifelong learning to use data from production (Nina and Martinsen, 2018). Data can be a source of work practice learning as well as running problems for more formal learning situations. This paper proposes a model for company implementation in terms of learning and discusses how it can produce integrations that are closer to learning activities in cyber-physical manufacturing systems without gaps.

According to [5], key technologies of industrial revolution 4.0 include artificial intelligence (AI), internet of things (IoT), advanced robotics, wearables, augmented reality / virtual reality, and 3D printing. Making Indonesia Industri 4.0 covers all aspects, including in terms of health. Industrial revolution 4.0 has also encouraged various innovations in the health sector [12]. The process of surgery, diagnosis, treatment, and treatment of patients has a lot to use robotic assistance, both from simple things to complex things. In handling patients, wearables / augmented reality / virtual reality are also used in several ways, such as through video or photos of the condition of an organ or a patient's illness. In the case of 3D printing, some health products can be produced from 3D printing using certain materials that are safe for the human body while IoT can be used to integrate the system or as a hospital database. One of the hospitals in Indonesia that implements IoT in an integrated system is the XYZ Hospital in Yogyakarta.

3.2 Research Site Selection

The number of hospitals in Indonesia is increasing. Since 2012 until now, there has been an increase of 5.2% on average. Public hospitals and private hospitals with a total of 2,773. The growth of public hospitals over the past six years is not as fast as the growth of private hospitals. The average growth of public hospitals is 0.4%, due to a decrease in the number of nonprofit private hospitals, while private hospitals are 15.3% [8]. The number of private hospitals compared to government hospitals is higher, with an average growth of 7%. While the growth of government hospitals is only 3%. Based on ownership, the profit growth of private hospitals is more aggressive than other types of hospitals. The average growth rate is 17 3 hospitals [11].

Hospital XYZ is one of the type A private hospitals in Indonesia that is internationally / globally oriented. The XYZ Hospital is supported by 35 Sub Specialist Doctors, 111 Specialist Doctors, 24 General Practitioners, Nurses, and Professional Paramedics in their fields, and has a large schedule of specialist doctors every day. Hospital XYZ uses various quality indicators to measure hospital performance and quality, such as management area indicators (IAM),

patient safety target indicators (ISKP), and clinical area indicators (IAK). XYZ Hospital uses various advanced technologies such as cath lab for diagnosis and treatment of heart disease, tumors and nerves, bone mineral densitometry (BMD) for bone density detection for osteoporosis, and mammography for tumor/breast cancer examination.

Hospital XYZ also optimizes its management with IoT in many ways. With the value of Hospital XYZ regarding patient safety (patient safety), Hospital XYZ optimizes IoT in managing it. Hospital XYZ implements Electronic Medical Record (ERM) as well as computerized patient medical record data stored in the computer system in the application of IoT to minimize unwanted human errors in the hospital service process. ERM includes the recording of drug administration, laboratory sampling, and actions during surgery, so that hospital processes are expected to be carried out correctly and precisely.

3.3 Hospital XYZ Business Process

There are several products offered by the Hospital XYZ, including Excellent services (cath lab, HBOT, healthy life center, ICU / ICCU, pregnancy club), emergency department, outpatient (poly), hospitalization, medical support (BMD, CT scans, endoscopy, physiotherapy, fluoroscopy, hyperbaric oxygen therapy, laboratories, mammography, MRI, panoramic teeth, abdominal ultrasound), vaccine clinics, and other services (hemodialysis, home laboratory services, home care services). This study discusses and evaluates outpatient business processes at the XYZ Hospital.

XYZ Hospital provides new and sophisticated medical equipment to help doctors get diagnoses of patients' illnesses and provide effective therapies. Increasing medical equipment is important for patients so that treatment can be done thoroughly. Examples of medical equipment include cathlab, BMD, mammography, HBOT, CT scan, endoscopy, physiotherapy, fluoroscopy, MRI, panoramic teeth, abdominal ultrasound, and haemodialysis.

Cathlab is used for diagnosis and treatment of heart disease, tumours, and nerves. Actions using a cathlab include a heart ring pair, intervention with a balloon, or bypass surgery. Bone mineral densitometry (BMD) for bone density detection for osteoporosis. Mammography for tumour/breast cancer examination. Hyperbaric oxygen therapy (HBOT) is a pure oxygen breathing therapy (100%) carried out in a high-pressure air chamber (chamber) with a pressure of> 1 ATA which can increase the concentration of oxygen in the blood plasma/blood fluid. HBOT can be used for therapy of sleep disorders, wound healing (diabetes/burns), overcoming hearing loss, vertigo, as well as fitness and beauty therapy. Physiotherapy is the process of rehabilitating a person to avoid physical disability through a series of prevention, diagnosis, and treatment to deal with physical disorders in the body due to injury or illness.

CT scans are medical examinations that use X-ray technology and computers as well. A CT scan allows the medical team to see what is happening inside the patient's body. Fluoroscopy is an X-ray examination method to produce video-like sequel images. Fluoroscopy is used to observe the condition of the body's organs directly (real time). As with CT scans, fluoroscopy uses X-rays to capture images. But the difference, fluoroscopy produces images from one perspective. Meanwhile, Endoscopy is an examination of the body cavity

using an endoscope that is used for diagnosis or healing. The technique with endoscopy uses optical fibre or video technology to enable the overall structure of the body to be inspected as a whole.

MRI (Magnetic Resonance Imaging) is an examination with detailed picture taking techniques of organs from various angles using magnetic fields and radio waves. MRI is safe to use for pregnant women and children. The method of using MRI can produce clearer images of organs, including for examination of tumours.

Panoramic teeth are one of the X-rays used in dentistry to get a picture of teeth and surrounding soft tissue. Panoramic examination is a non-invasive examination and is a simple extraoral procedure that describes the area of the maxilla and mandible on a film. Panoramic examination is also recommended for paediatric patients, physically handicapped patients, or patients with reflex disorders. Another examination procedure (periapical radiography) is usually performed to complete the panoramic x-ray in diagnosing.

Abdominal ultrasound is a medical ultrasonography to visualize the anatomical structure of the abdomen. Abdominal ultrasound uses ultrasonic wave transmission and reflection to visualize internal organs through the abdominal wall. Haemodialysis is the process of cleansing the blood of waste substances through a filtering process outside the body. Haemodialysis uses an artificial kidney in the form of a dialysis machine.

Patient safety is the main thing in hospital services. Accuracy in drug administration, laboratory sampling, actions during surgery, etc. must be carried out correctly and precisely. To that end, XYZ Hospital has implemented ERM (Electronic Medical Records). In addition to computerized patient medical record data stored in the computer system, human error can be reduced as well.

XYZ RS services can be done through applications from mobile phones and websites. Specifically for services via mobile phones, prospective patients must have been registered or have been examined at the hospital so that they have data on mobile numbers and medical record numbers to be able to enter the application. While for websites everyone can use it. Users can see doctor's practice schedules, queue info, and room availability. For the appointment menu with the doctor still cannot be used by using the website but can be used through an application with a certain quota.

Table 1. Business Process of Hospital

Outpatient Services Business Process	Application / Software	Administration	Nurse Station	Doctor	Patient	Pharmacy
Registration before D-day check (no registratio	Through the application, website (with	Through admission (with quota restrictions)			Get a booking code.	

Outpatient Services Business Process	Application / Software	Administration	Nurse Station	Doctor	Patient	Pharmacy
n is present	quota restrictions					
Registration on the D-day check (no registration is present)	Through the application, website (with quota restrictions)	Through admission (with quota restrictions)			Get a booking code.	
Registration on D-day (by attendance)	Record information	Through admission (with quota restrictions)			Queue numbers have been obtained during registration through the booking code of the application /website or through admission.	
The queue	Inform the queue number that is being checked, has been checked, as well as the order of the next queue number, displayed via the website, application, and screen available along.		Perform initial data collection: weight, blood pressure, temperature, complaints, drug allergies, and medical history.		Submit registration documents to the nurse station; queue check-in.	

Outpatient Services Business Process	Application / Software	Administration	Nurse Station	Doctor	Patient	Pharmacy
Come late	Reset the queue number sequence according to the procedure		Re-check the patient as long as the queue is passed 6 queues thereafter (1 person checked and 5 queues thereafter)		Patients who have been called 3 times in a row do not attend then have to re-check to the nurse station.	
Doctor's actions	Record history, send information to the cashier.			Take notes on actions and results of examinations and diagnoses.		
Patient's prescription	Record history, send information to the cashier and pharmacy department			Take notes of prescriptions given to patients.		Receive prescription notes from the doctor
Pharmacy Checkin	Record information				Checking pharmacy	Begin processing the patient's prescription
Payment	The system provides information about the amount that must be paid	Making the payment process by the patient			Make a payment	
Intake of drugs	The system informs				Take medicine	The pharmacy Departmen

Outpatient Services Business Process	Application / Software	Administration	Nurse Station	Doctor	Patient	Pharmacy
	patients to take medicine					t has finished preparing the drug

3.4 Analysis and Evaluation of Outpatient Hospital XYZ

According to Pinotty (2016), medical industry 4.0 includes network communication, cyber-physical system sensors, robots, 3D printers), collecting huge mass of data (big data analysis, cloud computing), ICT-based support for human workers (robots, augmented reality, intelligent tools), simulation, modeling and virtualization (product design and manufacturing processes), and information and communication technology (ICT) (networks, internet, IoT, IoS). In the case of outpatient services, the XYZ Hospital is assisted by the internet network to facilitate communication networks and data processing. This can accelerate the flow of business processes so that it is just in time. By managing databases with industry 4.0 components, productivity can be further increased [10].

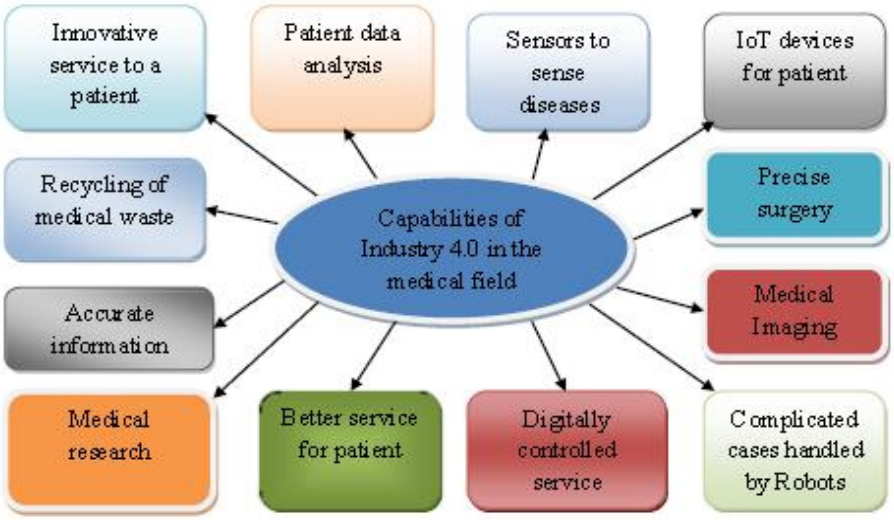

Fig 2 Capabilities of Industry 4.0 in The Medical Field [3]

The outpatient service business process in XYZ Hospital based on the ability of the industry 4.0 in the health sector is innovative service to a patient, patient data analysis, IoT devices for patient, better service for the patient, digitally controlled service, and accurate information.

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processes), and information and communication technology (ICT) (networks, internet, IoT, IoS).

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Based on medical industry 4.0, XYZ hospitals fulfil network communication, collecting huge mass of data, and information and communication technology (ICT). In the case of cyber-physical system, XYZ hospital fulfils the criteria but not yet fully. In the use of sensors or robots, XYZ hospitals use sophisticated equipment from medical equipment, but not yet for surgery using robots or producing products from 3D printers. In terms of ICT-based support for human workers (robots, AR, and intelligence tools) as well as simulation, modelling, and virtualization have not been fulfilled by XYZ Hospital.

In the capabilities of industry 4.0 in the medical fields, the new XYZ Hospital has several capability criteria and still needs to be developed. The capabilities of XYZ Hospital include innovative service to a patient, patient data analysis, sensors to sense disease, IoT devices for patients, precise surgery, medical imaging, better service for patients, medical research, and accurate information. Some things that still need to be optimized include complicated cases handled by robots, digitally controlled services, and recycling of medical waste.

Hospital XYZ already has 6 industry 4.0 capability in applying health. In the innovative service, it has implemented registration for treatment through the application, then the queue number is obtained during registration through the booking code of the application/website or through admission and records the doctor's actions automatically, then prescribes patients according to the doctor's actions or diagnosis and provides medication to patients by viewing information records from the doctor's prescription so that there are no errors in reading the doctor's prescription that may occur by pharmacists. For patient data analysis, Hospital XYZ has also applied it by obtaining patient data, which includes weight, tension, temperature, complaints, drug allergies, medical history automatically, which is obtained from the nurse station, which is then recorded information on the system. Accurate information has also been applied at the XYZ Hospital, including patient data, doctor actions, patient prescriptions, and drug-taking all have been integrated with one system to minimize errors in diagnosing patients and administering drugs. Good and fast service makes Hospital XYZ have implemented better service for patients. Of all the outpatient service business processes from the initial registration process to taking drugs at the XYZ Hospital, the Internet of Things has been implemented for patients.

Hospital XYZ has implemented INDI 4.0 covering products and services, people and culture, technology, plastic surgery, management, and organization. Products and services include data-based services, smart products that are registered, doctor's actions, patient prescriptions, drug-taking. Technology includes connectivity and digitalization, which are all connected to the internet, namely the internet of things (IoT) application. Factory operations include data storage and sharing that is all patient data related to the initial identification of name, weight, tension, temperature, complaints, drug allergies, medical history. Management

and organization include leadership strategy, innovation policy, namely the innovation policy of leaders who have implemented Industry 4.0 well.

In the future, Industry 5.0 will be available to handle the necessary medical processes with doctors / surgeons / technicians with fewer interventions, while doctors will do a higher level of work. Industry 5.0 will digitally help customers to manage repetitive tasks to be followed up. This new revolution is very encouraging for the manufacture of high quality medical components to meet patient demand. Collaborative robots are introduced to perform precise and complicated operations for patients in an efficient manner, which was not possible before. Industry 5.0 is used to meet very personal requirements with better efficiency. Sophisticated machinery and information technology are used to create virtual environments. Medical professionals are to move forward and take on different challenges like that as handling complex cases, treatment, care, teaching, research and development. It plays an important role in detecting diseases and in treating patients more easily. Used to produce smart medical parts, implants, bio-models, scaffolding, prosthetics, tools, and instruments. In the future, it will be helpful to suggest the right ingredients for the medical field, which creates faster recovery of patients. This revolution will improve the overall health care experience for patients and help doctors provide better, more efficient care.

4. CONCLUSION

Hospital XYZ has implemented Industry 4.0 in the business process of outpatient services, which includes innovative service to a patient, patient data analysis, IoT devices for patient, digitally controlled service, better service for the patient, and accurate information. Hospital XYZ has also been implemented based on INDI 4.0, including management and organization, people and culture, products and services, technology, factory operations. The outpatient service business process at the XYZ Hospital can be used as a reference for hospitals in Indonesia for industry 4.0 in all production facilities to increase hospital satisfaction and quality so that it better meets the needs of patients and positively increases hospitals.

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