BINUS UNIVERSITY
Faculty of Engineering

ICEED 2019

The 3rd International Conference on Eco Engineering Development

SUSTAINABLE ENVIRONMENT, ENGINEERING, ENERGY AND TECHNOLOGY DEVELOPMENT

CONFERENCE PROGRAM BOOK

WASKITA

UNIVERSITAS INDONESIA

PAPER • **OPEN ACCESS**

Preface

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Surabaya,
Dekan Fakultas Teknik
Dean Faculty of Engineering

Prof. Suryadi Ismadji, IPM.,ASEAN Eng.
NIK. 521.93.0198

Preface

PREFACE

It gives me a great pleasure to welcome you to the 3rd International Conference on Eco Engineering Development. On behalf of the organizing committee, I would like to express our deepest appreciation for your valuable contribution and participation in the 3nd International Conference on Eco Engineering Development (ICEED) 2019.

This event is an annual event in Engineering Faculty, Bina Nusantara University, where each year it has different theme. For this year, the theme is "Sustainable Environment, Engineering, Energy and Technology Development". The ICEED 2019 aims to develop a better understanding of Eco Engineering, Industry 4.0 and the Internet of things, considering the key changes towards sustainable development. In order to achieve this objective, ICEED 2019 focuses on five cores topics:

1. Sustainable Infrastructure and Transportation, Energy, Water and Renewable Energy
2. Sustainable Industry and Green Manufacturing
3. Sustainable Architecture
4. Integrated Smart Computing and Communication
5. Green Food Technology

This conference has received more than 230 manuscripts, and all those manuscripts were subjected to be peer-reviewed by the technical program committees. 186 papers have been accepted and the authors of those papers were invited to present their research findings in this conference. All those papers refer to one of the topics covered in ICEED 2019.

We would like to thank all authors, the keynote speakers, external reviewers and corporate sponsor for their committed contributions and their supports to the conference event of ICEED 2019. We also would like to thank IOP Publishing for collaborative support in publication of the conference proceedings.

Finally, I would like to thank the organizing committee members and reviewers for their hard work and outstanding team work. We wish you a most fruitful conference, and we will have a wider perspective and knowledge.

Dr. Oki Setyandito
Bina Nusantara University, Indonesia
Conference Chair ICEED 2019

Welcome Speech

WELCOME SPEECH

First of all, I would like to thank all invited speakers for taking the time to share your knowledge, insight and experiences with us today.

It is an honor for Bina Nusantara University especially Faculty of Engineering become an organizer of ICEED 2019. As Vice Rector of Research & Technology Transfer, this conference is one of our achievements, and it is a result of the growing awareness and willingness of the faculty member for sharing and gathering knowledge with practitioners, researcher, and community toward the green concepts. The appreciation of the participants makes this event rich with update knowledge that are ready to share with the community.

This year Binus Joint International Conference (BJIC) consists of 5 international conferences covering many disciplines ranging from sustainability and development, information management, engineering, technology, computer science, business, international relations, social science and humanities, namely:

1. International Conference on Biospheric Harmony (ICOBAR), chaired by Dr. Juneman Abraham, S.Psi., M.Si., was held successfully in Jakarta, 27 – 28 June 2019;
2. International Conference on Information Management and Technology (ICMTech), chaired by Drs. Suroto Adi, M.Sc., D.M.S, was held successfully in Bali and Jakarta, 19 – 20 August 2019;
3. International Conference on Computer Science and Computational Intelligence (ICCSCI), chaired by Dr. Derwin Suhartono, S.Kom., M.T.I., was successfully held in Yogyakarta, 12 – 13 September 2019;
4. International Conference on Business, International Relations, and Diplomacy (ICOBIRD), chaired by Moch. Faisal Karim, S.Sos., M.A., Ph.D, was successfully held in Jakarta, 9 – 10 October 2019;
5. International Conference on Eco Engineering Development (ICEED), chaired by Dr. Ir. Oki Setyandito, S.T., M.Eng., will be held in Solo, 13 – 14 November 2019.

These conferences show the strong commitment of BINUS University as world class university that ranked 801-1000 in QS World University Ranking 2020 to continuously produce, share knowledge, foster and empower the society. We collected more than 1,200 papers last year. We hope that we will get a similar number this year. But the most important thing is that these conferences become the best venue for networking for all participants. Therefore, I do appreciate for their tremendous contribution to these conferences.
Hopefully, this event can be held again in the coming year and become a house to discuss and share an up to date research and thoughts that are useful for Indonesia and the world. We really hope that you will enjoy ICEED 2019 and had a wonderful experience in the beautiful city of Solo as one of the tourist destinations in Indonesia.

Thank you very much.

Prof. Dr. Tirta Nugraha Mursitama, Ph.D
Vice Rector of Research & Technology Transfer BINUS University
General Chair BJIC 2019

First of all, on behalf of the organizing committee of ICEED 2019, we would like to welcome all delegates, all participants to Solo, Indonesia with great pleasure. Being held on November 13-14, 2019 at Lorin D'Wangsa Hotel Solo, proudly the third event of International Conference on Eco Engineering Development (ICEED 2019) is organized by the Faculty of Engineering, Bina Nusantara University.

The big theme of ICEED 2019 is Sustainable Environment, Engineering, Energy and Technology development, and we would like to give our appreciation and thank you to the conference organizers, all of reviewers, as well as all valuable authors for their contribution for making the successful of the event of ICEED 2019. We also greatly acknowledge our publishing partner, IOP Publishing, for their collaborative support in publishing the conference proceedings.

There are hundreds of manuscript papers have presented in the conference and hopefully become our contribution for the society as a role to bridge the harmony of the human wellbeing and the nature through the new advanced eco technology. In this event, we also spread eco-engineering concept to young generation through student competition consisting of posters and bursary essay.
Thank you very much.

Dr. Ir. John Fredy Bobby Saragih, M.Si
Dean of Faculty of Engineering, BINUS University
ICEED 2019 General Chairman

THE INTERNATIONAL CONFERENCE ON ECO ENGINEERING DEVELOPMENT 2019 (ICEED 2019)


ICEED 2019
THE 3RD INTERNATIONAL CONFERENCE ON ECO ENGINEERING DEVELOPMENT
SUSTAINABLE ENVIRONMENT, ENGINEERING, ENERGY AND TECHNOLOGY DEVELOPMENT
13TH-14TH November 2019


ICEED 2019
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Achieving sustainability through Industrial Revolution 4.0: An example in a small company in Surabaya

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Achieving sustainability through Industrial Revolution 4.0: An example in a small company in Surabaya

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Abstract. A study was performed with one small company to find out readiness of the company to perform operations of Industry 4.0. An interview was conducted with the owner of the company. and results were shown in the form of a diagram with low readiness, which means hard work for the owner and possibly consultants to bring the company into such level, ready to compete and sustain in the market.

1. Introduction

Being ready for Industrial Revolution 4.0 (IR 4.0) is needed for high quality products with accessible pricing, which would be performed by companies practising this technology. The manpower development to handle technology in this environment will influence future decisions made by other global companies in their decisions to invest in a country, which lately did not include Indonesia in their map (Anwar, 2019). The competitiveness of Indonesia was reported to improve, but still lower compared to its neighbours (CNBC, 2017).

Present regulation does not make it easy for companies to fire unproductive workers as severance pay stands at highest stand in the world. Ailing education system added to the quality of human resources needed in a manufacturing plant resulting to lowest FDI as share of GDP at 1.5%. The President promised to focus on improvement of education system, as well as the regulation for Ease-of-Doing-Business(The Economist, 2019).

The domestic market in the country is about two third of GDP, which is important to be supplied by domestic companies for better sustainability of the country, even without increasing the share of the slowing down export markets(UNDP, 2015). Major countries are currently facing difficulties in handling recession worries and would push their own products for global trade (Long, 2019), hence making it difficult for newcomers in export.

The role of KomiteIndustriNasional (KINAS) or National Industry Committee is headed directly by President Jokowi will improve technical condition of manufacturers to reach IR 4.0 level (Ministry-of-Industry, 2018).The National Development Planning Agency or BAPPENAS plans to build the human capital in Indonesia to suit a transition to a knowledge economy and thrive in the Industrial Revolution 4 through better education during the next five year plan for 2020 to 2025 (Pellini, 2018).

It is therefore important to find out how companies can ready themselves for IR 4.0 to be competitive and to sustain their competitiveness.How a small profitable company in Surabaya was trying to achieve this status was researched by interviewing the decision maker and owner. The methodology is following the assessment as described by Crimson & Co by interviewing the decision

maker/ owner of the company (Agca et al., 2017). The definition of the size of this small company is following the measurement used globally (Comstock, 2019).

2. Literature

Industry in Germany used the term IR 4.0 in Hanover for the first time in 2011. This was followed by publications from World Economic Forum amongst others with explanations about the different levels of the industrial revolution (Tsusaka, 2016), which classified the different revolutions as in Figure 1.

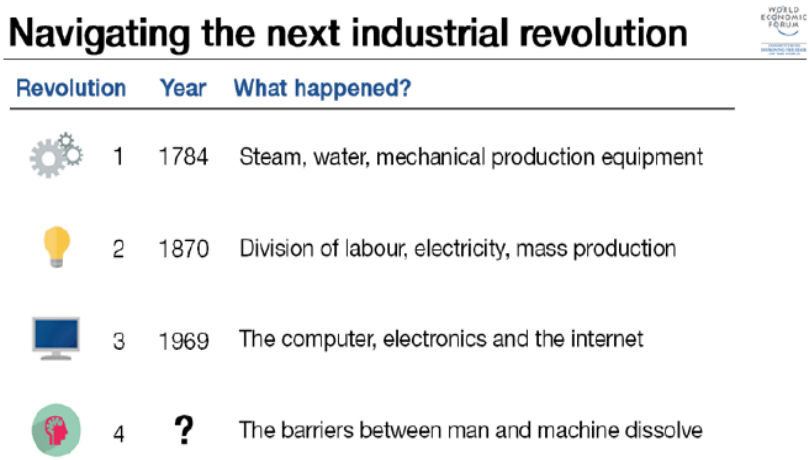

Figure 1. Navigating The Next Industrial Revolution (Tsusaka, M. 2016)

IR 4.0 creates changes in the individuals of a company. It will influence how we meet people and nurture relationships, the hierarchies upon which we depend, our health, and maybe sooner than we think, it could lead to forms of human augmentation that cause us to question the very nature of human existence. Such changes elicit excitement and fear as we move at unprecedented speed (Schwab, 2016). Companies practicing IR 4.0 will have the opportunity to grow even more with constant quality, and even more economically in terms of production cost.

The arrival of robots in a factory will create fear with employees of losing their jobs, but for 100 jobs lost in Germany due to automation 150 new jobs with higher requirements are created to handle technology of IR 4.0(Lorenz, M, et.all., 2015). The new jobs are necessary to manage nine technologies needed to operate IR 4.0(Rüβmann et al., 2015). Evenrecent studies by WEF increased this ratio of177 new jobs created for every 100 jobs lost globally (World Economic Forum, 2013).

An IR 4.0-ready manufacturing sector is expected to provide more than a quarter of the GDP increase at $34 billion, followed by retail at $25 billion, transportation at $16 billion, mining at $15 billion, agriculture at $11 billion, telecommunications at $8 billion, health care at $7 billion, public sector and utilities at $5 billion and financial services at $2 billion (Aisyah, 2019)

The readiness assessment tool is comprehensive in its nature. It looks beyond the technology to consider 6 core dimensions, with 37 sub-dimensions of industry 4 readiness. The core dimensions include: products and services, manufacturing and operations, strategy and organisation, supply chain, business model, and legal considerations (Agca et al., 2017).

More and more manufacturers are using packaged software like enterprise resources planning or ERP to handle more complicated processes in their plant (Harnisch Stefan, 2014)and to prepare better for further improvements in technology in production. Information derived from ERP program could provide better understanding of the business and simplify other operational activities such as production-history of a certain batch and many different financial information, as well as other technical competence factors to improve performance of the company (Madapusi, 2014).

Strategyof acompany should be in the development of internal expertise of customers' intimacy by improving IT capabilities with available personnel. Production to fulfil demand for consumers of their customers to be supplied would need flexibility in terms of needing the product earlier, due to

increased demand in the market.Expertise in IT and good product management could strengthen supply chain ability of a company, so as to react faster if demand for customers' products increases or decreases (Feki, et.all., 2016).

Resources in a company could change in line with needs and resources of the firm to follow a new business model. Additional automation in production would allow more accounts to serve using same resources configured in a different organization (McGrath, 2010). More sophisticated methods could be utilized to understand consumers' decision making process better through understanding their customer journey with a company using well designed IT tools (Wolny & Charoensuksai, 2014).

Legal considerations are of concern to a company becoming larger after successful operation, or the nature of the product needing patent protection/ intellectual property, as well as risk for straight forward business to be worried about. Also, contracts made with customers can bemore sophisticated with more orders to produce for different customers, which may need a system to manage accumulated data.

Traditionally, supply chain management (SCM) has been a melting pot of various disciplines, with influences from logistics and transportation, operations management and materials and distribution management, marketing including product management, as well as purchasing and information technology or IT (Giunipero,et.all., 2008).

The United Nations Development Programme (UNDP) is one of the leading organizations working to fulfil the SDGs by the year 2030. Present in nearly 170 countries and territories, UNDP help nations make the Goals a reality. To champion all Goals may be difficult for a small company, but to improve the industry by training its people to use technology innovating as with the Goal 9 is possible in a profitable industry with the right configuration to handle IR 4.0. A snowball effect of a sustainable company would allow eradication of poverty (Goal 1) through improvement in work and economic growth (Goal 8) to enhance peace, justice and strong institutions as Goal 16 (UNDP, 2015).

3. Methodology

This qualitative case study is performed in the sense of interview with results below and how the interview was conducted using questions from the protocol.

3.1. Interview

Qualitative analysis was performed using interviews with recording and transcript. This is in line with the methodology for face-to-face survey (Patton, 1990).The owner of a small company with 9 workers was interviewed and following the methodology a graph was made based on the results of the status in 37 sub-dimensions of the company. Products and services of this company was developed together with their customer as available manufacturer of finished products and supplier of raw material. The mould for each product is developed within the company and could represent strong point for customization to potential customers of the future. Using this expertise further targeting of bigger national companies would be the next step of the manufacturer. These new customers would compare newcomers to the available suppliers in terms of quality, price, production capacity, as well as speed of delivery using technology. All of these could be specifically attended to through digital product design of the products (Zawadzki & Zywicki, 2016). More details for better results in consultancy of the company are available for each of the 6 core dimensions. The protocol is following the scheme of Crimson and an interview was conducted using Internet by two interviewer and the owner of the company in Indonesian language. A transcript was made from the recorded interview and confirmed by the owner (Yin, 2016). The transcript was used as the source of this study as reported in the section Results.

3.2. Protocol

The interview was conducted using the protocol following the different descriptions of 6 core-dimensions and 37 sub-dimensions. The different ranking for the sub-dimensions as per methodology

described. Those points were filled in individually to arrive to the 6 core dimensions, which is shown in Table 1.

Table 1. Interview Protocol

Dimension	Subdimension	Protocol
Strategy & Organization	Strategy & Leadership	How does the strategy of the company handle IR 4.0?
		What are the activities performed for Quality 4.0?
		In what way is Operation 4.0 handled by the responsible person?
	Investment for IR 4.0	Please explain how the company decide on budget for the company to enforce IR 4.0 to your company?
		If investments were done throughout a certain period, how many per-cent of the budget does this expenditure represent as part of sales?
	Innovation Strategy	In what way does the company promote innovation in the company's strategy?
		Kindly explain in detail, if such strategy is available.
Business Model	Culture	Please explain how employees in the company accept new development with possibilities to replace their jobs by automation?
		If training is offered to handle this automation, which means that the employee would acquire new knowledge to handle innovative tasks, what would be the reaction of them?
		What strategy do your company have to use technology to improve productivity?
	Open to Change	How do you inform your employees about this strategy and their role in handling these changes to the better?
	Training Programs	What are the training programs the company planned or practised in line with objectives of the strategy to increase productivity to enable employees participating in this program?
Product & Services	Product Customization	Kindly explain how you customize your products in line with customers' demand!
		What are your commentaries to some products experiencing such process?
		Please explain the time it needs to perform these changes, as well as the cost involved in making this happen!
	Data-Based Services	Kindly explain your understanding about data-based services and the application in your company to be offered to customers!
	Smart Products	How would you describe as smart product with digital features in your assortment?
	Share of Revenue	How many percent of sales are included in data driven services?
Supply Chain	Cyber Security	What are the practical activities of responsible person for cyber security?
		What processes are involved in securing information of the company?
	Connectivity	How are different departments connected in the company?
		How is the process of connecting many other outside institutions to your company?
	Smart Machines	What is your understanding of smart machines in your company?
	Digitalization	How do you perform digitalization in your company?
		Please explain in details who is doing what in the process of digitalization even if there are more people involved in this task!
Manufacturing & Operation	Smart Maintenance System	Please explain how you handle maintenance of all sorts of equipment in the company?
	Autonomous Process	Please explain autonomous processes in the company, if such is available using Artificial Intelligence (AI).
	Supply Chain	How does your company handle supply chain from suppliers through

Dimension	Subdimension	Protocol
	& Smart Logistics	production department in your company and probable third party distribution until use of consumers?
		How is the process of triggering orders for supplies to the other party?
	Data Management	How does the company manage data from the totality of the supply chain from supplier to consumers?
Legal Consideration	Contracting Models	How do you start business with your customers using a work contract ?
	Risk	How do you minimize business risk in daily operation ?
	Data Protection	What are your measurement to protect confidential data from your company?
	Intellectual Property	Kindly explain how you submitted patent ownership for your product ?

4. Results

A small profitable company with 9 operators was contacted and the owner was interviewed. The owner had two customers, who are manufacturing and marketing compact powders. The product in the form of primary packaging is prepared from aluminium foil and pressed to the dimensions as required by the customer.

The product is in the form of primary packaging using aluminium foil with certain form for compact powder. Customers are specifying the form of the product and based on this a mould is made in the manufacturing plant internally. The product specifications were received from the customer and product was developed in the company starting from the mould. After trial batches at the customer's manufacturing plant are produced the packaging is approved, as was mentioned in the following,

After receiving samples of our product the manufacturing plant had to produce a mould for the filling of compact powder with correct measurement, dimensions, flexibility etc. to be tried in their manufacturing process before agreeing on our product. This process is important, as corrections will increase costing at the customer's plant.

The production process starts with order from customers. Raw materials are checked and if necessary ordered, after arrival production will start without referring to any manufacturing history generated by an Enterprise Resources Planning or ERP system, nor batch numbering using any process like bar code printer nor QR printing, as basically there is one product with several sizes. In troubled cases the owner complained,

At one stage I would like to trace-back history of production, but it is not available using bar code or the like. Ideally, there is a small code printed on the aluminium foil.

There is a sound strategy of the company in maintaining safety of its workers. Otherwise, order bookings were performed very traditional. Orders were issued by the customer to start the process of manufacturing in the company. The owner proudly said,

Frankly, we have not yet defined our strategy with specific targets. It is important that operations flow smoothly and safety of operators are guaranteed.

During former interviews the owner mentioned that he himself is delivering the productand at the same time further develop personal contact. There is no use of a transportation agency to supply customers with the product. Supply chain at present is simple. Few suppliers and few customers are handled by the owner himself. This opportunity is also utilized to keep relationship with customers warm. The owner is booking the order, as well as sending the products himself, so as to find out eventual reactions towards the product directly from the users of the products.

The feedback of customers during these visits concerned only about quality of the product, which would make tracing back the manufacturing history bit complicated.The use of IT is only related to necessary calculations and printing of invoices. All is performed under management of the owner. No Product Management nor efforts to understand customers in their journey with their consumer products (Wolny & Charoensuksai, 2014)is necessary at this present stage. The business model is just

simple based on orders, production and delivery. Training is based on operation of the machines in production, as was mentioned as follows,

Customer feedback only concerns quality of our products. Complaints are seldom as we are careful with the mock up process, but such if available will be settled on a case basis. No information about market was received and collected using IT.

Legal structure of the company seemed to be at its simplest form with necessary production licenses.

Based on the interview an evaluation of the different dimensions and the subdimensions (Agca et al., 2017) was calculated. Total Readiness results with scale of 1 up to 4 for the non-nominee company (NN) is as follows at Table 2.

Table 2. Total Readiness Results

No.	Dimension	Total Readiness
1	Strategy & Organization	2.3
2	Business Model	1.8
3	Product & Services	1.4
4	Supply Chain	1.5
5	Manufacturing & Operation	1.5
6	Legal Consideration	1.3

Total Readiness results with scale of 1 upto 4 for the non-nominee company (NN) also presented in Figure 2.

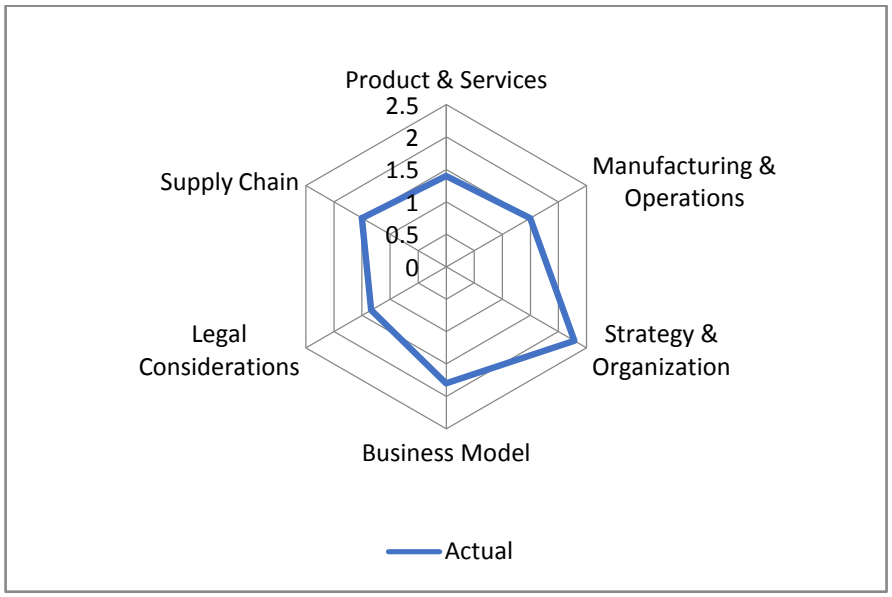

Figure 2. Total Readiness

Calculation of readiness index above show the the company's readiness for IR4.0 still needs to be improved

Conclusion

Strategically the company should develop an information system using ERP as a start and develop further to improve customer relationship. The decision to purchase a robot suitable for these operations is necessary to increase flexibility of operations with different products for higher or lower numbers. Excellence in operation would benefit manufacturing using IR 4.0 technology and developing measurement system using Key Performance Indicators or KPIs. After one semester the experience

using ERP and the robot would provide good selling points to other manufacturers of compact powders in the country.

The configuration of the organization using 9 people would require personnel to be retrained in handling ERP and performing product management. The sales management performed by the owner at present should slowly be handed over to the product manager. One of the 7 employees for operations should be chosen as the head of the team after showing best results of KPIs in one year.

Product Manager to develop consumer expertise by developing social media for users of the compact powders in general. Based on the input of the consumers more product enhancements would be able to be proposed to the manufacturers willing to improve their products.

Using information system and better manufacturing processes together with configuration of the organization better understanding of the business, as well as flexibility to handle customers in line with market dynamics could increase sustainability of the company.

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