

Lesson Learned of Business Strategy for Commercializing An E-Motor Cycle Technology: A Comparative Study

Silvi Istiqomah, Wahyudi Sutopo

Master Program of Industrial Engineering Department

Universitas Sebelas Maret

Surakarta, Indonesia

silviistiqomahaja@student.uns.ac.id, wahyudisutopo@staff.uns.ac.id

Rina Wiji Astuti

CEO of Start Up Technology

PT Batex Energi Mandiri

Surakarta, Indonesia

rinawijia@gmail.com

Abstract

The development of electric vehicles is growing fast due to a positive impact on the environment in reducing carbon emissions. This research provides priorities that can be used for start-up based technology to commercializing an e-motor cycle. This is done by exploring the innovation system and technopreneurship of a successful company as a lesson learned of business strategy, provided a study of technology commercialization based on comparative research from e-motor cycle companies. Comparative study used based on case studies of both Gogoro and Bajaj as e-motor cycle companies. Comparing the strengths and weaknesses of companies and the opportunities used to face existing threats will help researchers to understand the commercialization process and strategies. This study produces a proposed model for manufacturing e-motor cycle for successfully commercializing technological innovations.

This research based on a comparative analysis of E-motor cycle companies based on case studies. Quantitative studies are used as a comparison and complement so that the conclusions generated can be more valid as a basis for commercialization models for other companies. Furthermore, this study suggests how the start-up interface commercializes technology. This paper is a step forward in filling the literature gap regarding the appropriate technology commercialization model for electric vehicles.

Keywords

Comparative Analysis; Commercialization Technology; E-motor Cycle; Global Business.

1. Introduction

Every successful organization is need a sound business model whether it is a new venture from an established organization or a start-up (Lambert, 2006). The global strategy is very important for a company to cover the entire network of subsidiaries and partners, this strategy is implemented for many countries simultaneously and increases synergy in many countries. A technology based start-up requires a technology commercialization strategy to explore and exploit the technology resulting from research and in production or consumption activities so that companies can benefit from activities (siegel et al, 2003; Wicksana, 2015). While Siegel and Marconi (1989) argue that commercialization is an activity to make a technology to the point of profit or profit. Nlemvo (2002) states that commercialization consists of design, development, manufacturing, initial marketing phases, and everything about product development.

Now businesses often have the option of going global, they assess a range of considerations before beginning such expansion. By implementing the global strategy, the company can compare the performance appraisal of the company among global businesses. To achieve these conditions, the company needs to regulate the industrial organization model (I / O), the model of resource development and the ability of corporate organizations to make changes in the face of existing money competition. n China, most of the growth in production and consumption

of electric vehicles is driven and supported by Chinese government regulations, this is done with the aim of reducing traffic density and air pollution. Similarly, in Europe, the increase in sales of electric vehicles is caused by incentives that have been given by the government (Boston, 2016). Apart from the tendency to open up research and development and the commercialization process in high technology, the small high-tech weapons in this study seem to pursue a more closed approach to R&D than in other business functions such as marketing and sales (Pellikka et al, 2014). This study builds and validates a framework for theoretical models to drive innovation, technology modes and business models to explain the underlining factors and driving mechanisms in which new entrants lead in the electric vehicle market (Lia et al, 2014)

This paper provided a study of technology commercialization based on comparative research from e-motor cycle companies. The companies to be compared are Gogoro and Bajaj, these two companies are e-motor cycle manufacturers with a fairly large market. Both Gogoro and Bajaj use various strategies in order to achieve conditions above the average return. With this research, it will illustrate the business model for commercializing the e-motor cycle at an easy stage. This research provides priorities that can be used for start-up based technology to commercializing an e-motor cycle. We explore the innovation system and technopreneurship of a successful company as a lesson learned of business strategy. This paper provided a study of technology commercialization based on comparative research from e-motor cycle companies.

2. A Framework of Comparative Study

Case studies taken from Gogoro and Bajaj companies which have developments in the commercialization of e-motor cycle production. The research approach by comparing the strengths and weaknesses of companies and the opportunities used to face existing threats will help researchers to understand the commercialization process of e-motor cycle technology. In the first stage, we analyze the external and internal environmental conditions of the company to be compared, from this the vision and mission can be formulated easily. The second stage is the execution of strategic actions. The strategies of the two companies need to be studied to determine learning and analysis that will be a reference for future development, several aspects need to be elaborated, namely resources, capabilities, competitive advantage, attractive industry, and the formulation of strategies to find out the advantages of a company. Next, we analyze the formulation and implementation of strategies. Finally, we elaborate the strategic competitiveness from a both case study to elaborate how achieve an above-average return.

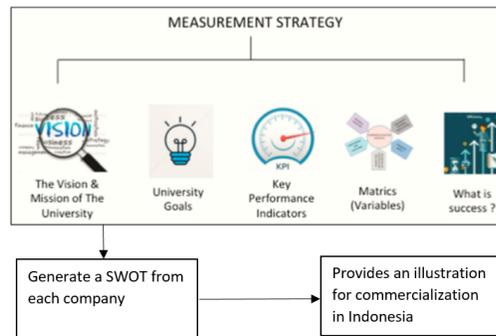


Fig 1. Comparative Strategy

This business model will be a good illustration in the development of e-motor cycle that will be marketed to the public. The data are collected from several research sources and also news that discusses the development of the two companies. Literature studies are also conducted with the electric vehicle keyword from several journal sources such as scopus, sciencedirect, elsevier, and several other platforms to collect data related to Gogoro and Bajaj companies. There are twenty-five papers that become the reference in this research, besides that a lot of supporting data and information obtained from the company's web and several business commercialization sites.

3. Result and Discussion

The following is a comparison of the two companies that will be compared. This comparison will illustrate the advantages and disadvantages between the two companies which will be used as material for analyzing the situation of e-motor cycle companies which will be used as a reference in developing the business commercialization of electric vehicles.

3.1 Resource and Capabilities

Taiwan already has existing electric scooters (Fig 2), which one of the most successful one is the company called Gogoro. Currently, the company is growing fast and has plans of expanding outside of Taiwan (Gogoro.com. 2020). The Company have a plan in years to come and increase from their 4% market share to the dominance of more than 50%. ((Gogoro.com. 2020). Gogoro have resource and capabilities to produce and distribute several series with simple and elegant designs. This electric motor has flexible's design, it can make nimble movements in driving. In addition, this design also considers the anthropometry of potential users. It has an application to determine the performance conditions of each electric vehicle and provide good service with the application on every e-motor cycle user gadget.

Capability development is viewed as path dependent (Nelson and Winter, 1982). The description of this research shows the direction of Taiwan trying to move. They focus on the fields of renewable energy, energy saving and in the green industry which will have a good impact. This results in increased interest in alternative modes of transportation. It is as important to have effective infrastructure in the industrial sector as it is in the transportation sector. The Taiwanese government has invested 1.74 billion US dollars for renewable energy at the end of 2010 (Wang, 2011). This shows that Taiwan is thinking about the future and making the right solution, this solution will benefit them in the future. The Renewable Energy business in Taiwan is quite attractive internationally and Taiwan has many companies involved in the renewable energy and energy efficiency sectors (Wang, 2011).



Fig 2. E-motor cycle from Gogoro
(Source : Gogoro.com)

Bajaj Auto is the largest company in India for scooter and motorcycle manufacturers. Indian industrial companies that still exist in competition against manufacturers with Japanese technology with experience investment. The highest sales of production at that time were the lowest-priced scooters in the world, the Bajaj company was a Bajaj family company and was driven by the Bajaj family for generations from the start (Bajajauto, 2020).

Bajaj is one of the motorcycle manufacturers with many types of motorcycles, Cheetak is one type of electric vehicle with quite a high demand. This electric vehicle has a pretty good design and performance. Intense competition keeps Bajaj from rising by starting sales in several hospitals and abroad during the 1997 calendar year. Bajaj are considered to produce low-tech, low-cost vehicles making the cycle not good especially its competitors who always offer their best technology, especially in high-speed motorcycles, especially consumers of the bottom who are the Bajaj market target also began quiet due to the minus purchasing power due to recession in India.

The company began to invest in new plant technology in the city of Pune, to prepare a new idea, namely to introduce new models of products that are powered more quickly. For the sake of improvement, the Bajaj Company has spent Rs 7.5 billion (\$ 185 million) just to update their technology, computer equipment and factory machine tools. All of this is needed by Bajaj to make new models that meet the emission standards that will be more stringent in 2000. Bajaj began installing and embedding Rs 800 technology to improve the 2-stroke (two-stroke) scooter products they produced from 1999.



Fig 3. Electric Vehicle from Bajaj
(Source : Bajajauto.com)

Bajaj have some capabilities. Partnerships start with humility: While Bajaj Auto had exceptional engineering capabilities, world class manufacturing capacity with great quality and some strong brands, he needed to be present in all categories of motorcycles. He needed strong brands in each category. The ‘Bajaj’ brand, despite its strength was not enough. The number of products that have been developed makes Bajaj have a bigger market than Gogoro.

3.2 Competitive advantage

Gogoro considered that his company was not a motorcycle maker as well as an energy management company. Because Gogoro is quite good with its AI system that can turn off electricity during non-peak hours, the company provides battery stations at several points in Taiwan that can operate for 48 hours without power. Gogoro has around 1,610 locations located in all department stores, supermarkets, and parking lots in Taiwan. Gogoro users can travel long distances on the island without thinking about lack of power. They can also enter the battery station and exchange batteries within six seconds, this makes the waiting time disappear so that the user feels more effective and efficient. With subsidies from the Taiwanese government, the basic Gogoro price, including the exchange of two-step engine scooters, is NT \$ 39,000 (\$ 1,276.00). The cost of electricity used to run Gogoro is also almost the same as the cost of conventional fuel. Gogoro has upgraded his AI system to charge batteries at swapping stations to decide when and where to charge batteries. Gogoro aims to extend battery life at the same time because it draws power from the electricity network during non-peak hours.

The Gogoro partnership, the total number of battery exchanges carried out across the Gogoro Energy Network has reached 25 million. The reliability of this system has won the trust of industry partners, companies that are Gogoro's partners include Yamaha, Aeon, and PGO. Some of these major vehicle brands have made the Gogoro Energy Network their core technology platform for new e-scooters to be released in 2019. When the three manufacturers that work with Gogoro separately develop their e-scooters, the company will also continue to integrate control systems electronics, smart batteries, and the battery exchange mechanism were first made by Gogoro.

There are several collaborations carried out by the Gogoro company in developing the company. B2B partnership with DHL, DHL International logistics company has also announced that its operations center in Taiwan will build a "green logistics fleet" that will be connected to the Gogoro Energy Network. This is done in hopes of ushering in a new era for low carbon logistics solutions. The next partnership with Yamaha, the collaboration with Yamaha is related to the development of Gogoro and the manufacture of electric scooters for Yamaha and sharing the battery exchange system, and signing an official contract anticipated this year. Yamaha will design Yamaha-brand electric scooters based on Gogoro production vehicles, with production handled by Gogoro. Sales of electric scooters from the new Yamaha company in the Taiwan market will be made through the sales channel of a local subsidiary of Yamaha Motor Taiwan.

The population of electric scooters is not the largest in Taiwan, Gogoro 2019 electric scooter sales rose 105% compared to 2018. Last year, Gogoro successfully marketed 145 thousand units or 21.3% of Taiwan motorcycle sales. For the electric motorcycle market, Gogoro's market share has reached 86%. In fact, there was a month that recorded sales of Gogoro up to 22,700 units. Gogoro's success is supported by massive infrastructure. In Taiwan

there are now 1,575 charging stations. Active users of the Gogoro electric scooter alone reach 270,000 people. Taiwan's population in 2018 reached 23.78 million people, so that among 88 Taiwan residents there is 1 user of Gogoro.

Taiwan is a country with the fourth largest bicycle rental user. The business plan that will be carried out by Gogoro is to sell scooters in Taiwan and rent them out in Berlin and Paris. This bicycle rental already exists among the people. Maybe in the near future they will make changes to rent an electric motorcycle in Taiwan and sell it in Europe or vice versa. This is done to keep up with user trends so the company can continue to grow (Gogoro.com, 2020). In the capital city of Taiwan, Taipei, there are currently two main providers of emission-free electric scooters, the first company named Gogoro (Gogoro.com, 2020) and the other is China Motor Corp (Fulco, 2017). Both companies see market opportunities for small electric vehicles.

Table 1. Comparison Market Share of Gogoro and Bajaj

	Gogoro	Bajaj
Market Share	21.3 % of Taiwan sales	18.69 % from some city
Unit Sales	22.700 unit	2.541.320 unit
Charging Station	1.575 Charging Station	Not detect

Bajaj is a two-wheeled industry in India which has witnessed spectacular growth in recent years. The market dynamics of the electric motor industry have changed substantially with the majority of users preferring bicycles over scooters and mopeds. This is mainly due to better fuel efficiency, dynamics, appearance and longer product life than motorbikes.

The motorcycle segment constitutes around 81.5% of the two-wheeled vehicle market in India. This contributes to three quarters of total exports in the two-wheeled vehicle industry. Bajaj is the second largest player in this segment after Hero Honda. This company not only has operations in India but operates in several other countries which help the company to be competitive in front of its competitors. PT. Bajaj Auto Indonesia, a subsidiary of Bajaj Auto with 99.25% stake and Bajaj Auto International Holdings BV, Netherlands (BAIH BV) is a 100% subsidiary of Bajaj Auto Ltd. These subsidiaries are involved primarily in manufacturing various types of KTM motorcycles.

Between April-July 2019, Bajaj Auto despatched a total of 781,914 motorcycles, which marks a 1.73 percent YoY sales decline for the company. The company closed in 2019 with a market share of 18.69 percent (2,541,320 units), having notched 28.7 percent growth. The bike maker had a 15.69 percent market share in 2018 (1,974,577 units). In the first four months of 2020 (April-July 2019), Bajaj Auto has clocked sales of 781,914 units (-1.73%). In the current depressed market conditions, that single-digit decline is better than what the three two-wheeler biggies are seeing right now: Hero MotoCorp - 2,317,005 (-14.93%), Honda Motorcycle & Scooter India - 1,798,615 (-18.21%) and TVS Motor Co - 920,121 (-6.24%).

3.3 Strategy Formulation and Implementation

Exports and imports are market entry techniques by offering the lowest level of risk and the least market control. The highest risk, but also the highest market control and expected return on investment are related to direct investments that can be made as acquisitions (sometimes called Brownfield) and Greenfield investments (Terpstra and Sarathy, 2001). A framework for evaluating the commercialization strategies available to novice innovators operating in the high-tech industry (Stenard et al, 2016).

The analytical tool used to produce business strategy solutions is SWOT analysis, IFE-EFE matrix, and QSPM models so that the results will be the most interesting and suitable for use by companies (Saputra et al, 2018). This important organizational resource will help simplify planning around the world and help build corporate brands with a consistent image across markets; thus this planning will improve the performance of the company's marketing strategy (Zou and Cavusgil, 2002). Research that clarifies the idea of 'organizational boundary permeability' in the Open Innovation literature and investigates the role of gatekeepers for open innovation (Wilhelm and Dolfsma, 2017).

Table 2. Comparison product of Gogoro and Bajaj

	GOGORO	BAJAJ
Speed	50 km/h	90 km/h
Power	27/202 Nm @ 0-2,250 rpm	2507.5 BHP @ 5500 rpm
Brakes	SBS (Synchronized drum brake on the rear)	brake on the front and a
Design	braking system)	Elegant Design
Dimension	Elegant and simple	1770 x 670 x 1080 mm
AI	1730 x 690 x 1035 mm	Smartphone
Annual Revenue	Smartphone	4,4 B
Estimated Employee	< 1 M	10.258
Industry sector	750	Motorcycle Manufacturers
	Motorcycle manufactures, automobile dealers, service providers, online platform	

Gogoro is one of the biggest competitors. Currently they aim to conquer the market with their new GoCharger Mobile service for drivers (Gogoro.com, 2020). Gogoro is one of the most influential companies in the Taiwan market for electronic scooters and potential or threat partners. Gogoro focused on developing new battery technology and charging applications, which might serve as potential partnerships for e-bike companies (Gogoro.com, 2020).

With the SWOT from this company, a strategy can be formulated that will be used as a solution to the existing problems. Elango and Pattnaik (2007) propose that networking capabilities have a direct impact on the internationalization strategy of the firm.

Bajaj has the strength of the company that can be used as the strength to develop and compete with other companies. This company also has a strategy that has been implemented to get a good market compared to its competitors. The study that has been conducted presents the relative efficiency of research commercialization with the data envelopment analysis (DEA) model used to obtain the efficiency level of the TTO strategy from the observed performance (Sutopo et al, 2019)

The strength of this company is brand positioning. Bajaj Auto is the fourth largest manufacturer of two-wheeled and three-wheeled vehicles in the world. The company produces several types of vehicles, namely motorcycles, passenger carriers and goods carriers. Bajaj Auto through its subsidiary Bajaj Auto International Holdings (BAIH) has a 48% stake in Europe's second-largest sports motorcycle manufacturer, KTM from Austria. KTM has a fairly strong brand equity globally and the alliance with Bajaj Auto helps the two companies to provide sustainable services that focus on offering cost-efficient and positive quality benefits that can be felt by its users. The KTM manufacturer has given Bajaj Auto a broad global reach. Bajaj Auto has many dealers spread all over India and always maintains a smooth supply chain. Bajaj Auto was ranked 96th in the list of the most innovative companies in Forbes in 2014. Bajaj auto has a 13% market share in the two-wheeled vehicle category.

But the Bajaj has a weakness that is Lack of Presence in the scooter market, Bajaj Auto was the leader in the scooter market until the momentum of the motorcycle rose in the 1990s. Bajaj closed its scooter business post, but the scooter business expanded and showed a 12% growth in 2016. Not a global brand, even after producing in high volumes, Bajaj is not recognized as a global brand. It hasn't entered other markets or developed internationally as fast as possible. This is an Indian market player.

There are several opportunities that can be done by Bajaj companies. Growth of the motorcycle market: Global motorcycle manufacturing is expected to grow strongly in the coming years. According to market lines, the global motorcycle industry generated around \$ 75,000 million in 2016. This shows growth of around 6.3%. The market is expected to grow at 7% CAGR for the 2016-19 period to around \$ 93450 million. The three-wheeled vehicle market recorded an 11.51% growth in FY2016 and is expected to grow at a CAGR of 4.4% to around \$ 4.2 billion in 2017. Bajaj Auto must further seek to strengthen its product portfolio as it has done in the past with Avenger Pulsar, Discover models, etc. By continuing to develop new technologies into its portfolio,

Bajaj's image as an innovative company will also be maintained. Research on programming has been carried out to support the commercialization of capital budgeting and the production of lithium accumulators (Wijayanti et al, 2019)

4. Lesson Learn from The Analysis

There are several things that can be drawn from the comparison of the two companies. Each has advantages and disadvantages of each.

Gogoro has the ability to develop products with good technology collaboration so that the products produced are quite interesting and very up to date. Power and several other features are also quite attractive to consumers to have an electric vehicle from Gogoro. Government regulations in Taiwan strongly support the development of the electric vehicle industry so that it provides some encouragement for the industry to develop. The speed in pursuing the development of electric vehicle manufacturing is quite good, even though the company is still new but has been able to become one of the electric vehicle manufacturers that has good cooperation and patents.

Table 3. SWOT design for manufacturing electric vehicles in Indonesia

Strengths	Weakness
<ul style="list-style-type: none"> • Indonesian people's desire for ease of use • Word of mouth strategy in Indonesia is massive • Does not require expensive fuel 	<ul style="list-style-type: none"> • The price is quite expensive • Choice of types electric vehicle is not so much • The cost of building a charging station is quite expensive
Opportunities	Threats
<ul style="list-style-type: none"> • Making pollution conditions in Indonesia reduced • Not yet available competitors of electric vehicle manufacturing companies 	<ul style="list-style-type: none"> • Technology development is not good enough • Less massive government support • Optimization of placement of charging stations that have not been designed

In addition, Bajaj has a fairly good network and marketing ability, this company also does not produce just one type of vehicle. Bajaj company is the lowest-cost scooter maker in the world. Market of this company is quite a lot and broad, this is because of the right marketing and targeting strategies in marketing products. The product developed is also quite varied, this makes Bajaj one of the best manufacturers at a fairly cheap price.

Indonesia can be one of the new players in making electric vehicles, with the conditions of the two companies being compared. Indonesia needs good support from the government in developing and marketing electric vehicle products. This is seen from the positioning of Indonesian people who still do not have the ability and desire to have an electric vehicle. Therefore, regulatory support from the government helps people easily choose to have an electric vehicle.

Theoretically, this research uses various literatures in measuring the performance of electric vehicle commercialization that will be commercialized in Indonesia. While practical, this research provides information on the relative important points of Indonesia's planning strategy for commercializing electric vehicles, which can be further developed in various ways.

5. A Framework of Comparative Study

Comparative analysis of two electric vehicle companies has been carried out. This analysis is carried out by looking at the various circumstances of the two companies and taking a strategic management approach. The results of this study can be used as a basis for developing global business strategies for companies to get better development and a basis for decisions to expand. Comparison of companies made includes two companies working in the same line of business, this results in two databases that can complement each other's shortcomings. This information is obtained from each company's web that has shown a company profile that can later be adopted. From the results of the analysis that has been carried out, technology commercialization was

successfully carried out for several reasons, namely understanding the strengths and weaknesses of the company that will be explored or overcome, understanding the conditions of the community, and understanding the opportunities and weaknesses that exist. There is a weakness in this research, this research is only based on the second more data that can be obtained, the development of the environment and the development of companies that continue to develop must be considered in determining the commercialization of technology that will be carried outside.

Comparative Study

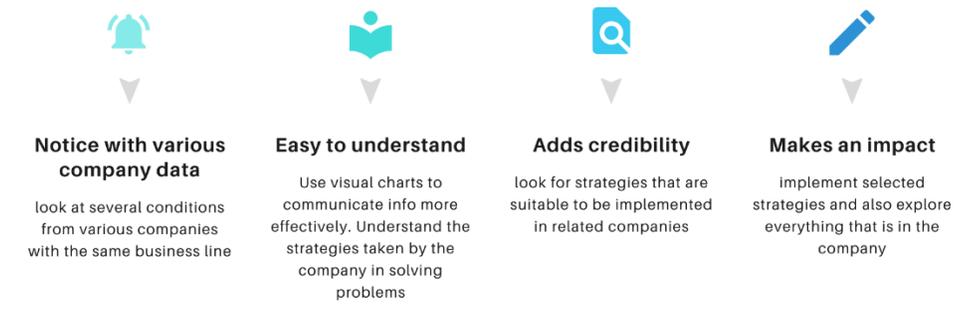


Fig 4. Comparative study

Suggestions for further research are complete data from several companies that will be compared, so the results obtained can describe the current conditions that will determine the decision or direction of company development that makes it a reference in compiling business strategies. With the condition of this company comparison, there are several things that can build the environment in the electric vehicle business that will be developed in Indonesia. This study provides an overview of the design and market development that will be handled by the company..

References

- Boston, W., 2016. European union sees surge in electric vehicle sales. Wall StreetJ.
- Dehkordi. M. A., Yonekura. S. 2013. Descriptive analysis of Nissan's electric vehicle commercialization strategies. Journal of Product & Brand Management 22/5/6 (2013) 393–403
- Elango, B., & Pattnaik, C. 2007. Building capabilities for international operations through networks: A study of Indian firms. Journal of International Business Studies, 38(4), 541–555.
- <https://www.bajajauto.com/> (Accessed on April 15, 2020)
- <https://www.gogoro.com/> (Accessed on April 15, 2020)
- https://www.marketwatch.com/press-release/e-scootermoped-and-e-motorcycle-market-potential-growth-and-demand-analysis-2019-energica-motor-company-govecs-group-gogoro-zero-motorcycles-2019-09-19?mod=mw_quote_news (Accessed on April 16, 2020)
- Lambert, A. 2006. A Business Model Research Schema, in 19th Bled eConference eValues. Bled, Slov
- Lia. X., Liub. W., Zhang. B., Meng. D. 2018. New entrants versus establishers in China and US electric vehicle marketplace: a comparative analysis, Asia Pacific Business Review, DOI: 10.1080/13602381.2018.1512258
- Fulco .M. 2017. Taiwan Today, E-scooters surge ahead. Read 29.01.2018
<https://taiwantoday.tw/news.php?unit=8&post=114992>
- Malik. T. H. 2013. Institutional barriers in the diffusion of a high technology A case of biotechnological innovation from a Chinese university. Journal of Chinese Entrepreneurship Vol. 5 No. 1, 2013 pp. 4-25

- Nelson, R., & Winter, S. 1982. An evolutionary theory of economic change. Harvard University Press
- Nlemvo, N.; Pirnay, F.; Surlemont, B. 2002. A Stage Model of Academic Spin Off Creation. *Technovation* 2002, 5, 281–289. 53.
- Pellikka, J.T. And Malinen. P. 2014. Business Models in the Commercialization Processes of Innovation Among Small High-Technology Firms. *International Journal of Innovation and Technology Management* Vol. 11, No. 2 (2014) 1450007
- Saputra, I.W., Sutopo, W., Zakaria, R. 2018. A Business Strategy Formulation For Commercializing University-created Technology: A University Spin-offs. The 3rd International Conference on Industrial, Mechanical, Electrical, and Chemical Engineering AIP Conf. Proc. 1931, 030020-1–030020-9; <https://doi.org/10.1063/1.5024079> Published by AIP Publishing, 978-0-7354-1623-9/\$30.00
- Siegel, G.; Marconi, H.R. 1989. Behavioral Accounting; Thomson South-Western: Mason, OH, USA.
- Siegel, D.S.; Waldman, D.; Link, A. 2003. Assessing the impact of organizational practice on the relative productivity of university technology transfer offices: An exploratory study. *Res. Policy* 2003, 32, 27–48. [CrossRef]
- Stenard, B. S., Thursby M. C., Fuller. A. 2016. Commercialization Strategies: Cooperation Versus Competition. *Technological Innovation: Generating Economic Results Advances in the Study of Entrepreneurship, Innovation and Economic Growth*, Volume 26, 289-308
- Sutopo, W., Astuti, R.W., & Suryandari, R.T. 2019. Accelerating a technology commercialization; with a discussion on the relation between technology transfer efficiency and open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 5(4),95. <https://doi.org/10.3390/joitmc5040095>.
- Sutopo, W., Kurniyati, I., Zakaria, R. 2018. Markov Chain and Techno-Economic Analysis to Identify the Commercial Potential of New Technology: A Case Study of Motorcycle in Surakarta, Indonesia. *Technologies* 2018, 6, 73; doi:10.3390/technologies6030073
- Terpstra V., Sarathy R. 2001. *International Marketing*, 8th edn., Chicago IL, Dryden Press.
- Wang, W. 2011. Top ten highlights of CleanTech in Taiwan. Read 08.02.2018. <http://cleantechies.com/2011/04/20/top-ten-highlights-of-cleantech-intaiwan/> (Cleantechies)
- Wicaksana, D.E.P.; Yunaristanto, Y.; Sutopo, W. 2015. Identification of Incubation Scheme by Incubator in University Innovation Center to Develop Indonesian Economy. In *Proceedings of the Joint International Conference on Electric Vehicular Technology and Industrial, Mechanical, Electrical and Chemical Engineering (ICEVT & IMECE)*, Surakarta, Indonesia, 4–5 November 2015.
- Wijayanti, C.I., Sutopo, W., & Zakaria, R. 2019. Goal Programming Model for Capital Budgeting Investment of Lithium Accumulator Production Unit for Motorcycle. *Proceeding - 2018 5th International Conference on Electric Vehicular Technology, ICEVT 2018*, 8628397, pp. 107-111. DOI: 10.1109/ICEVT.2018.8628397.
- Wilhelm, M., Dolfsma, W. 2017. Managing knowledge boundaries for open innovation - lessons from the automotive industry. *International Journal of Operations & Production Management*, <https://doi.org/10.1108/IJOPM-06-2015-0337>
- Zou, S., & Cavusgil, S. T. 2002. The GMS: A broad conceptualization of global marketing strategy and its effect on firm performance. *Journal of Marketing*, 66(4), 40–56.

Biography / Biographies

Silvi Istiqomah is Student at Master Program of Industrial Engineering of Universitas Sebelas Maret, Surakarta, Indonesia. She is also an assistant of System Logistic and Business Laboratory at Universitas Sebelas Maret. She received her Bachelor degree from Universitas Sebelas Maret in 2019. Her research interests are in supply chain, logistics, business, techno economy, and sustainability. She has published some papers in her research area.

Wahyudi Sutopo is Professor in Industrial Engineering and Coordinator of Industrial Engineering and Techno-economy (RITE) Research Group, Dept. of Industrial Engineering, Faculty of Engineering, Universitas Sebelas Maret, Indonesia. He earned his Ph.D. in Industrial Engineering & Management from Institut Teknologi Bandung in 2011. He has published journal and conference papers and his research interests include logistics & supply chain management, engineering economy & cost analysis, and technology commercialization. He has received more than 30 research grants. Dr. Wahyudi Sutopo has done research projects with Indonesia Endowment Fund for Education (LPDP), Sustainable Higher Education Research Alliances (SHERA), MIT-Indonesia Research Alliance (MIRA), PT Pertamina, Tbk, PT Toyota Motor Manufacturing Indonesia, and various other companies. He is a member of IIE and IEOM.

Rina Wiji Astuti is an alumni of Industrial Engineering Masters Program at Sebelas Maret University, Surakarta, Indonesia. She also focused on research in the field of Logistics and Business Systems. Now she is the CEO of PT Batex Energi Mandiri.