

Innovation Readiness Analysis of Battery Electric Vehicle: A Case of Gesits G1

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Abstract: Battery Based Electrical Vehicle development's urgency in Indonesia is for improvement, efficiency, and energy conservation in transportation sector and to actualize clean energy and air, as well as the nation's commitment to reduce greenhouse gas emission. The biggest challenge these vehicle products faced are competitors from giant markets such as China and Japan as well as the procurement of the main component which still rely heavily on import, hence the need for the Innovation Readiness Levels (IRL) to give answer to innovation development with an effective cycle. Innovation Readiness Levels is a framework used to identify, evaluate, and measure an organization's readiness level in adopting and implementing innovation. Six points in innovation includes concept, components, completion, chasm, competition, and changeover/closedown. The identification results shows that the innovation readiness in KATSINOV 5 reaches 75, 83% as well as on the measurement aspects of IRL, the market aspect have a lowest KATSINOV of 65, 71%, while the partnership, risk, and technology have the biggest KATSINOV level of 80%, hence it is classified in the IRL measurement did not reach the minimum limit and so improvement is needed in every aspect. Finally, the recommendation given is for effectivity improvement, organization cooperation, and also product differentiation and partnership to increase the competition in the market.

Keywords: Innovation Readiness Levels, Electrical Vehicle, KATSINOV, Innovation, Battery.

Introduction

Battery-based electric motor vehicles are a type of vehicle that uses an electric motor as the main power source to drive its wheels, and this electric power is stored in batteries. The urgency of developing electric vehicles in Indonesia is to increase energy efficiency and energy conservation in the transportation sector, and the realization of clean energy, clean air quality and environmentally friendly, as well as Indonesia's commitment to reduce greenhouse gas emissions. These battery-based electric vehicles are expected to significantly reduce imports of fuel oil (BBM), support renewable energy targets to strengthen national energy security, as well as spur the development of domestic industry and human resources (HR) towards the largest electric vehicle production base in the ASEAN region.

The toughest challenge faced by electric motor vehicle products developed by the nation's children is when entering the market, considering that many competitors of similar products from abroad such as China and Japan are very interested in entering the Indonesian market. In addition, the procurement of the main components of electric motorized vehicles, namely batteries, electric motors, and electric current regulating modules or inverters, still relies on imports, making it less profitable in terms of competitiveness against similar products from abroad.

Facing these problems, it is necessary to conduct Innovation Readiness Levels (IRL). The IRL concept is used to provide answers in the development of innovation with a cycle that has been running effectively. Innovation management needs to be measured, because in the face of competition between competitors it is necessary to

make a design that describes the development of innovation in helping to implement innovation. The application of IRL measurement is divided into 6 levels of readiness, namely concept, component, completion, chasm, competition, and move or stop. The focus of this research is to measure the level of readiness or maturity of innovation carried out in GESITS. This research is subject to a constrained time frame at OREM BRIN, which is for one month from January 2, 2023 to February 3, 2023.

Methods

This research uses quantitative research methods, using primary data collected directly by researchers. The data includes observation, interviews, and documentation (Widodo et al., 2022). Before analyzing Innovation Readiness Levels, it is very important to understand the concept of Innovation Readiness Levels itself, where there are 6 levels of IRL, namely concept, component, completion, chasm, competition, and changeover/closedown, and there are 7 aspects analyzed, namely technology, market, organization, partnership, risk, manufacturing, investment.

Innovation Readiness Levels (IRL) is a framework used to measure and describe the readiness of an organization, project, or initiative to adopt and implement innovations. The concept is similar to Technology Readiness Levels (TRL) used in the context of technology development, but IRL is broader in scope as it covers all types of innovation, not just technology. IRL helps organizations to understand the extent to which they are ready to accept, implement, and integrate innovations in their operations.

The research workflow began with the identification of relevant literature and field studies. Next, the data is processed using the innovation readiness level method with KATSINOV measurement. The data that has been processed is then presented descriptively in the results and discussion section, resulting in conclusions and recommendations for companies and future researchers.

The utilization of Innovation Readiness Levels (IRL) can be used to help the interests of organizations, projects, and individuals to measure readiness to adopt and implement an innovation. This can improve the evaluation of innovation projects, strategic planning, and measurement of success in the overall formation of an innovation.

Location

OREM BRIN (Organisasi Riset Energi dan Manufaktur) is part of the BRIN (Badan Riset dan Inovasi Nasional) that focuses on research and development in energy and manufacturing. After acquiring BPPT (Badan Pengkajian dan Penerapan Teknologi), BPPT came under the auspices of BRIN in September 2021. However, in January 2022 BRIN abolished BPPT and replaced it with OREM. Situated on Gedung 625 Puspiptek Serpong, Tangerang Selatan, Banten, Indonesia. BRIN aims to encourage economic growth, increase competitiveness and sustainable development in Indonesia through research and innovation. BRIN has an important role in directing investment, resources and cooperation between the government, universities, research institutions and the private sector in order to develop technology, improve the quality of human resources and overcome the challenges faced by Indonesia.

Innovation Readiness Levels (IRL)

Innovation Readiness Levels (IRL) is a measurement tool or method for estimating the innovation readiness of a technology from a technology innovation program in industry/institution.

Innovation Readiness Levels (IRL) is a framework used to evaluate the readiness level of an innovation or technology before its application in real-world situations. It is a tool that helps in measuring the extent to which an innovation has evolved and how ready it is to be adopted or implemented in a practical context. Measurement and Determination of Innovation Readiness Levels (KATSINOV) or Innovation Readiness Levels (IRL) is an effort to answer the demand for measurement tools that can describe the development of innovation and implement innovation over the life cycle more effectively.

Thornhill (2006) in (Rosli, 2013) defines innovation as a process of idea creation, development of novelty, and introduction of a new product, process or service to society. In addition, (Pearce, 2013) also argues that innovation is the initial commercialization of an invention by producing and selling a new product, service, or process. According to (Sukmadi, 2016), innovation means a new idea that is not yet widely known by most people in a particular locality, which can be used or encourage changes in all aspects of community life.

(Roberts, 2003) states that innovation can be done in two ways, namely radically and incrementally. Radical innovation means creating a completely new product, which is generally done with a technology push, while incremental innovation is done through improving or perfecting existing products at a previous time, which is usually associated with market pull.

Innovation is a multi-dimensional concept consisting of four dimensions (Zahra S. A., 1993) and (Anatan L. &, 2009) and (Perwiranegara, 2015). The multidimensional concept of innovation above will produce better measurements than only one dimension (Hadjimanolis, 2000). (Zahra S. A., 1993) in (Anatan L. &, 2009) states four dimensions of innovation consisting of leadership orientation, innovation 'followership', sources of innovation, and the level of investment.

Technology adoption and diffusion refers to the process by which a new technology is introduced into an organization or society and then spreads through adoption by more users. This concept is usually associated with technological innovation and the study of how new technologies are accepted, learned, and used by society. According to Rogers (2003), technology adoption involves five main stages: knowledge, persuasion, decision, implementation, and confirmation. These stages reflect the journey of an individual or organization from knowing a new technology to using it regularly.

(Tao, 2008) states that when research begins, the need for a managerial approach increases in order to support the innovation process. IRL-Meter (Innovation Readiness Level - Meter) or KATSINOV-Meter (Innovation Readiness Level -

Meter) is a measurement tool used to measure the level of readiness or maturity of innovation carried out by a company and/or project/program/activity. The KATSINOV-Meter uses an innovation life-cycle approach, which can describe the development of innovation. The IRL conceptual framework is the 6 "C" model (Concept, Component, Completion, Chasm, Competition, Changeover/Closedown) which comprehensively separates the innovation life cycle into 6 phases (readiness levels) and provides direction for management in carrying out the innovation process by paying attention to 7 key aspects (technology, market, organization). Each phase is projected on five aspects including technology, market, organization, partnership and risk (Lan et al., 2010). Further development of the IRL concept has also been studied by Lee, et al. (2011), which accommodates innovation theories such as product life cycle, system readiness level, market adoption model, and technology readiness level. The overall framework for assessing IRL is depicted in Figure 2.1.

The IRL framework helps stakeholders to understand the readiness level of an innovation and identify the steps that need to be taken next to commercialize it or integrate it in business practices or daily life.

Below is a measuring tool used in the innovation readiness levels method using KATSINOV (Figure 1, 2, 3).

Key Aspects	Technological Development			Market Evolution		
	IRL 1 Concept	IRL 2 Components	IRL 3 Completion	IRL 4 Chasm	IRL 5 Competition	IRL 6 Changeover / Closedown
Technology	Potential improvements of existing technologies or products identified and reported; Technology feasibility confirmed	Individual components tested; Prototypes demonstrated; IP protected	Actual system demonstrated; External test completed; IP protected; Technology/product documented; Launch	Expertise formed; General availability to the market; Aftersales support	Lower R&D activities; Technology maintenance enabled; Technological service provided	Re-innovate or exit
Market	Market research conducted; Working with leading customers; Customer needs and demands observed	End-customer identified; Detailed market launch plan issued	Specific needs and requirements of customers known; Market segment, size and share predicted; Pricing & Launching issued	Positioning in the market; Business model established; Customer intimate marketing (feedback); Competitors identified; Partnership is an option to break into market	Products differentiated; Service and solutions provided; Periodical review conducted; Business model refined; Partnership is an option to compete	Declining market confirmed; Market research conducted for approval to reinnovate or exit
Organization	Strategy fit confirmed;	Business analysed and plan issued; Key individuals involved	Formalising organisation	Formal organisation established	Improved effectiveness and cooperation; Necessary restructure made	
Partnership	Potential partners identified	Partners selected; Calibration established	Partnership formally established	Cooperation within dynamic network; On-going management		Cease partnership
Risk	Technology risk considered	Technological risk assessed (alternative solution considered); Market risk assessed; Organisational risk considered (investment plan initiated and investment started)	Technological risk assessed; Organisational risk assessed (profit predicted; large investment issued)	Organisational risk periodically assessed (especially financial indicators)	Organisational risk periodically assessed (especially financial indicators)	Re-innovate or exit considered; Changeover or closedown plan issued

Figure 1. Innovation Readiness Levels Research Framework

Innovation readiness framework is a framework or conceptual model used to identify, evaluate, and improve organizational readiness to adopt and implement innovations (Ogut et al., 2019). This framework involves various factors that affect organizational readiness, such as organizational culture, leadership, resources, and innovation capabilities. By using the innovation readiness framework, organizations can improve their weaknesses and strengthen their strengths in adopting and implementing innovations (Shi et al., 2020).

6 Tingkat Kesiapan Inovasi (KATSINOV)
(IRL, Innovation Readiness Level)

KATSINOV	Penjelasan
6	Pindah (change-over) atau berhenti (close-down)
5	Kompetisi (Competition): Ini merupakan fase kematangan pasar, yaitu ketika tercapai suatu kesetimbangan (equilibrium) pasar dengan ketiadaan pertumbuhan bermakna atau inovasi.
4	Chasm: Chasm berada diantara <i>early adopters (the enthusiasts & visionaries)</i> dan <i>early majority (the pragmatis)</i> . Telah dilakukan tahap awal introduksi hasil inovasi ke pasar. Pada tahap ini terdapat tantangan dan kesulitan apakah produk inovasi bertemu dengan kebutuhan atau permintaan pelanggan ketika pertama kali diintrodukir ke pasar.
3	Penyelesaian (Completion): Pengembangan teknologi telah diselesaikan dan seluruh fungsi sistem telah terbukti di lapangan (ekivalen dengan TRL 7 - 9).
2	Komponen (component): Komponen telah dikembangkan dan divalidasi, dan prototype telah dikembangkan mendemonstrasikan teknologi (ekivalen dengan TRL 4 - 6).
1	Konsep (concept): Prinsip-prinsip ilmiah dasar dari inovasi telah diamati dan dilaporkan, dan fungsi kritikal dan/atau karakteristik telah dikonfirmasi melalui eksperimen (ekivalen dengan TRL 1 - 3).

Figure 2. 6 Levels of Innovation Readiness (KATSINOV)

Innovation measurement is the process of collecting, analyzing, and interpreting data to measure the level of innovation in an organization or business environment. Innovation measurement can be done using various methods, such as surveys, financial analysis, and organizational performance measurement. According to Chesbrough and Rosenbloom (2002), innovation measurement can provide benefits in decision-making and identifying opportunities and challenges in innovation development. Meanwhile, Rothwell and Dodgson (1994) suggest that innovation measurement can also help in identifying key factors that affect innovation success.

ASPEK	PENGEMBANGAN TEKNOLOGI			EVOLUSI PASAR		
	KATSINOV 1	KATSINOV 2	KATSINOV 3	KATSINOV 4	KATSINOV 5	KATSINOV 6
TEKNOLOGI	Penelitian (Research)	Pengembangan (Development)	Engineering & Operation	Introduksi Produk Teknologi	Tahap Layanan Teknologi	Inovasi Utang atau Pengembangan Teknologi Baru
PASAR	Identifikasi Kebutuhan Pasar	Target Pasar Teridentifikasi	Kebutuhan Khusus Pelanggan Teridentifikasi	Positioning Produk di pasar	Diferensiasi Produk	Review & Ekspansi Pasar
ORGANISASI	Identifikasi Arah Organisasi	Penetapan Arah Organisasi	Formalitas Organisasi	Pengembangan Kolaborasi Organisasi Dengan Mitra	Penguatan Kolaborasi Organisasi Dengan Mitra	Dukungan Organisasi & Jejaring Dalam Menetapkan Exit Strategy
KEMITRAAN	Identifikasi Mitra	Seleksi Mitra	Formalisasi Kemitraan	Kejasama Dalam Jejaring	Optimalisasi Kejasama Dalam Jejaring	Evaluasi Kemitraan Yang Telah Berjalan & Pencarian Mitra Baru
RISIKO	Identifikasi Risiko Tahap Penelitian	Kajian Risiko Tahap Pengembangan Teknologi	Kajian Risiko Tahap Engineering & Operation	Kajian Risiko Organisasi (khususnya indikator keuangan) pada tahap introduksi Produk ke pasar	Kajian Risiko Organisasi (khususnya indikator keuangan) pada tahap kematangan pasar tercapai	Kajian Risiko terhadap keputusan Inovasi Utang atau Pengembangan Teknologi Baru
MANUFAKTUR	Solusi Material	Pengembangan Teknologi produksi	Engineering & Uji Produksi	Produksi Skala Penuh	Manajemen Produksi Yang Baik	Inovasi Produksi atau Pengembangan Teknologi Produksi Baru
INVESTASI	Konsep Model Bisnis	Market Value proposition	Validasi Bisnis	Peningkatan keberterimaan Di Pasar	Ekspansi Pasar	Review kebutuhan dan permintaan pasar

Figure 3. Framework KATSINOV

GESITS

Gesits, which stands for "Golden Generation of Electric Vehicles Based on Electric Bicycles and Motorcycles", is a national project initiated by the Indonesian Ministry of Research, Technology and Higher Education in 2015. The goal of the project is to develop and mass-produce an environmentally friendly and affordable electric motorcycle.

The Gesits project started as a response to the serious air pollution problem in many Indonesian cities, especially in Jakarta. Conventional motor vehicles, such as motorcycles with gasoline engines, contribute to high levels of air pollution and environmental damage.

The gesits partnership program refers to a cooperative program between the government of the republic of Indonesia and several private companies in developing and promoting motorcycle-based electric vehicles in Indonesia with the aim of reducing air pollution and dependence on fossil fuels through the use of environmentally friendly electric vehicles. In this partnership, the government cooperates with several companies such as PT PLN (Perusahaan Listrik Negara), PT Wika Industri Manufaktur, PT LEN Industri, as well as a higher education institution ITS (Institut Teknologi Sepuluh Nopember) which has been involved in the development and testing of the Gesits electric motorcycle.

The partnership involves technology development, production, distribution, and operation of electric motors in Indonesia. The main objective of the partnership is to increase public awareness of electric vehicles and encourage the adoption of electric vehicles in Indonesia. Through the Gesits partnership, the government provides incentives to consumers in the form of subsidizing

the purchase price of Gesits electric motorcycles, in order to encourage Indonesians to replace conventional motorcycles with environmentally friendly electric motorcycles.

Data Collection

The information collection process is carried out to obtain information and data on the object of research related to the measurement of the IRL framework with the 6 C model (Concept, Component, Completion, Chasm, Competition, Changeover/Closedown), which comprehensively separates the innovation life cycle into 6 phases (readiness level), and provides direction for management in carrying out the innovation process by paying attention to 7 aspects (technology, market, organization, manufacturing, investment, partnership and risk). Information was collected through direct observation and complemented by the results of filling in the KATSINOV measuring instrument by researchers from BRIN in observing the innovation readiness analysis of battery-based electric motorized vehicles at GESITS. Below is a summary chart showing the results of the questionnaire conducted using KATSINOV, which displays each IRL level as well as the 7 aspects that have been analyzed from the GESITS G1 battery-based electric motor vehicle.

KATSINOV 1								
Σ atau % terpenuhinya ▶ Indikator KATSINOV 1 [beri tanda cross (X) pada kolom yang sesuai]								
/beri tanda cross (X) pada kolom yang sesuai/								
No	Aspek	0	1	2	3	4	5	
[0=tidak terpenuhi; 1=20%; 2=40%; 3=60%; 4=80%; 5=100% atau terpenuhi]								
1	I						X	
2	T						X	
3	T						X	
4	T						X	
5	T						X	
6	M						X	
7	M						X	
8	M						X	
9	O						X	
10	O						X	
11	O						X	
12	O						X	
13	Mi						X	
14	Mi						X	
15	Mi						X	
16	I						X	
17	I						X	
18	I						X	
19	P						X	
20	P						X	
21	R						X	
22	R						X	
Σ		0	0	0	0	15	7	
%		86.36%					TERPENUHI	

Figure 4. KATSINOV Level 1

KATSINOV 2														
Σ atau % terpenuhinya						Indikator KATSINOV 2					KATSINOV 2			
[beri tanda cross (X) pada kolom yang sesuai]						[beri tanda cross (X) pada kolom yang sesuai]								
No	Aspek	0	1	2	3	4	5	(0=tidak terpenuhi; 1=20%; 2=40%; 3=60%; 4=80%; 5=100% atau terpenuhi)						
1	T						*	Telah melakukan validasi terhadap komponen individu dari teknologi.						
2	T						*	Prototipe telah didemonstrasikan dalam lingkungan yang relevan.						
3	T						*	Teknologi dinyatakan layak secara teknis.						
4	T						*	Telah melakukan pendaftaran kekayaan intelektual (misal: paten, desain industri, hak cipta, merek, dll).						
5	T						*	Secara teknis mampu memberikan solusi terhadap permasalahan yang dihadapi masyarakat.						
6	M						*	Pelanggan akhir teridentifikasi.						
7	M						*	Telah mengeluarkan rencana peluncuran produk baru ke pasar secara rinci.						
8	M						*	Telah memulai kesiapan modal intelektual (intellectual capital).						
9	O						*	Analisis dan rencana bisnis telah dikeluarkan.						
10	O						*	Telah memiliki keterlibatan dengan individu kunci.						
11	O						*	Telah melakukan persetujuan persyaratan proyek dan daftar mitra proyek.						
12	O						*	Telah melakukan persetujuan tanggung jawab dan persetujuan batas waktu dalam pengelolaan suatu proyek.						
13	Mi						*	Identifikasi teknologi dan komponen kritikal telah komplet.						
14	Mi						*	Material, perkakas dan alat uji prototipe, maupun keahlian personel telah diperhatikan oleh sub system/system dalam suatu lingkungan produksi yang relevan.						
15	I						*	Keunggulan nilai jual yang dimiliki telah teruji kepada pelanggan.						
16	I						*	Solusi yang ditawarkan kepada pelanggan memunculkan daya tarik yang menguntungkan di pasar.						
17	I						*	Validasi value proposition, channel, segmen pelanggan, model hubungan dengan pelanggan yang ada, dan aliran revenue terbuka telah dilakukan.						
18	P						*	Telah melakukan pengalihan informasi dan seleksi mitra.						
19	P						*	Pola kemitraan dibangun dengan tepat.						
20	R						*	Kajian risiko teknologi telah dilakukan dalam setiap langkah pengembangan teknologi.						
21	R						*	Pada tahap pengembangan teknologi dilakukan penyusunan rencana pengendalian risiko teknologi.						
		0	0	0	0	10	11							
	Σ							95						
	%							90.48%						TERPENUHI

Figure 5. KATSINOV Level 2

KATSINOV 3														
Σ atau % terpenuhinya						Indikator KATSINOV 3					KATSINOV 3			
[beri tanda cross (X) pada kolom yang sesuai]						[beri tanda cross (X) pada kolom yang sesuai]								
No	Aspek	0	1	2	3	4	5	(0=tidak terpenuhi; 1=20%; 2=40%; 3=60%; 4=80%; 5=100% atau terpenuhi)						
1	T						*	Sistem aktual teknologi telah didemonstrasikan dalam lingkungan yang sebenarnya.						
2	T						*	Uji eksternal dan teknologi yang dikembangkan telah dilakukan secara lengkap, dalam rangka memenuhi persyaratan teknis dan kesesuaian regulasi.						
3	T						*	Telah mendokumentasikan teknologi yang dikembangkan.						
4	T						*	Hasil Inovasi telah diperkenalkan.						
5	T						*	Telah memperoleh Kekayaan intelektual (misal: paten, desain industri hak cipta, merek, dll).						
6	M						*	Kebutuhan khusus dan keperluan pelanggan telah diketahui.						
7	M						*	Segmen, ukuran dan pangsa pasar telah diprediksi.						
8	M						*	Produk telah diperkenalkan, dan harganya telah ditetapkan.						
9	O						*	Penetapan organisasi (struktur bisnis dengan staff dan kolaborator).						
10	O						*	Identifikasi beberapa tambahan staff yang dibutuhkan.						
11	O						*	Telah menincikan pembagian tanggung jawab dan beban kerja.						
12	Mi						*	Desain sistem sebagian besar stabil dan terbuka dalam uji dan evaluasi.						
13	Mi						*	Proses dan prosedur manufaktur terbuka dalam skala pilot.						
14	Mi						*	Produksi pada laju rendah telah dilaksanakan.						
15	I						*	Telah mendefinisikan kondisi akhir dan produk teknologi dengan mempertimbangkan target person, pasar vertikal, serta geografik.						
16	I						*	Validasi terhadap bisnis yang dilakukan sudah diterapkan.						
17	I						*	Identifikasi dan validasi terhadap indikator kinerja utama yang mengindikasikan keberhasilan bisnis.						
18	P						*	Telah terjalin kemitraan secara formal.						
19	P						*	Telah menyusun dan telah menerapkan rencana kerja sama.						
20	R						*	Kajian risiko teknologi menjadi dasar pengambilan keputusan teknis dalam tahap engineering & Operator.						
21	R						*	Pada tahap penerapan teknologi dilakukan penyusunan rencana pengendalian risiko teknologi.						
		0	0	0	0	15	16							
	Σ							90						
	%							85.71%						TERPENUHI

Figure 6. KATSINOV Level 3

KATSINOV 4														
Σ atau % terpenuhinya						Indikator KATSINOV 4					KATSINOV 4			
[beri tanda cross (X) pada kolom yang sesuai]						[beri tanda cross (X) pada kolom yang sesuai]								
No	Aspek	0	1	2	3	4	5	(0=tidak terpenuhi; 1=20%; 2=40%; 3=60%; 4=80%; 5=100% atau terpenuhi)						
1	T						*	Telah terbentuk keahlian terkait pengoperasian dan pemeliharaan produk teknologi.						
2	T						*	Penggunaan umum produk teknologi oleh cakupan pasar yang luas telah diidentifikasi.						
3	T						*	Keuntungan teknologi melalui hasil pengujian telah diidentifikasi.						
4	T						*	Adanya dukungan terhadap adopsi produk teknologi oleh pasar.						
5	M						*	Telah membangun citra produk teknologi kepada pasar.						
6	M						*	Model bisnis ditetapkan.						
7	M						*	Pesaing diidentifikasi dengan baik.						
8	M						*	Pemasaran ditekankan pada pengenalan secara spesifik produk teknologi kepada para pelanggannya.						
9	O						*	Telah menetapkan bentuk organisasi.						
10	O						*	Telah mengembangkan kemitraan dengan organisasi independen.						
11	O						*	Identifikasi peluang untuk memperkenalkan produk kepada mitra dan pasar baru.						
12	Mi						*	Telah diperhatikan produksi yang menguntungkan secara finansial.						
13	Mi						*	Mulai menerapkan GMP (Good Manufacturing Practice) atau Lean Manufacturing.						
14	Mi						*	Mulai menerapkan jaminan mutu sesuai standar (SNI).						
15	Mi						*	Adanya tuntutan masyarakat terhadap mutu, keamanan dan keselamatan produk yang dimartakan.						
16	I						*	Potensi pasar teridentifikasi.						
17	I						*	Daya terima pasar terhadap produk telah teridentifikasi.						
18	P						*	Melakukan kerja sama di dalam jejaring usaha secara dinamis.						
19	P						*	Terus melakukan pengelolaan terhadap kerjasama yang sudah berjalan.						
20	R						*	Penyusunan rencana pengendalian risiko non teknologi (organisasi dan sosial) pada tahap pengenalan produk ke pasar.						
21	R						*	Kajian risiko organisasi (khususnya indikator keuangan) dilakukan pada tahap pengenalan produk ke pasar.						
22	R						*	Kajian risiko dampak sosial pada tahap pengenalan produk ke pasar.						
		0	0	0	1	8	13							
	Σ							100						
	%							90.91%						TERPENUHI

Figure 7. KATSINOV Level 4

KATSINOV 5								
		Indikator KATSINOV 5 [beni tanda cross (X) pada kolom yang sesuai]						
Σ atau % terpenuhinya		[beni tanda cross (X) pada kolom yang sesuai]						
No	Aspek	0	1	2	3	4	5	
		(0=tidak terpenuhi; 1=20%; 2=40%; 3=60%; 4=80%; 5=100% atau terpenuhi)						
1	T						X	Adanya garansi terhadap produk teknologi yang dipasarkan.
2	T						X	Layanan pemeliharaan produk telah disediakan.
3	T						X	Pasokan suku cadang untuk produk teknologi telah disediakan.
4	T						X	Adanya aktivitas pengembangan dengan intensitas lebih rendah, untuk peningkatan kerja produk teknologi sesuai permintaan pelanggan.
5	M						X	Telah menyediakan pelayanan dan solusi yang lengkap.
6	M			X				Telah melakukan diferensiasi produk.
7	M						X	Telah melakukan penyempurnaan model bisnis.
8	M						X	Telah menggunakan kemiripan untuk berkompetisi di pasar.
9	O						X	Telah meningkatkan efektivitas dan kerjasama.
10	O						X	Telah melakukan penataan kembali struktur perusahaan sesuai kebutuhan.
11	O						X	Identifikasi peningkatan peluang pertemuan produk teknologi dengan kebutuhan pasar.
12	O						X	Telah melakukan peninjauan proses teknis dan komersial untuk meningkatkan harga dan keuntungan.
13	MI						X	Menerapkan GMP (Good Manufacturing Practice) atau Lean Manufacturing secara intensif.
14	MI						X	Adanya kebutuhan saran (baik internal maupun eksternal) kepada manajemen untuk perbaikan kinerja.
15	MI						X	Telah menerapkan jaminan mutu sesuai standar (SNI) secara intensif.
16	MI						X	Adanya jaminan terhadap mutu, keamanan dan keselamatan produk yang dimanfaatkan oleh masyarakat.
17	I						X	Kebutuhan perluasan pasar telah diidentifikasi.
18	I						X	Adanya peningkatan kapasitas produksi.
19	P						X	Peningkatan kerjasama di dalam jejaring secara dinamis.
20	P						X	Telah melakukan peningkatan mutu pengelolaan pada produk yang sudah berjalan.
21	P						X	Kerja sama dalam distribusi dan pemasaran produk.
22	R						X	Penyusunan rencana pengendalian risiko non teknologi (organisasi dan sosial) pada tahap kematangan pasar tercapai.
23	R						X	Kajian risiko organisasi (khususnya indikator keuangan) pada tahap kematangan pasar tercapai.
24	R						X	Kajian risiko dampak sosial pada tahap kematangan pasar tercapai.
	Σ							91
	%							75.83%
		TIDAK TERPENUHI						

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5

Figure 8. KATSINOV Level 5

Results and Discussion

Measurement of Innovation Readiness Levels (KATSINOV)

Innovation Readiness Level (IRL) as a measurement tool used to measure the level of readiness or maturity of innovation in a project. The IRL measuring instrument uses the innovation life cycle, by describing the development of innovation which has 6 IRL Levels, namely concept, component, completion, chasm, competition, and changeover/closedown. The IRL level will meet the achievement or be achieved if it reaches the minimum limit of 80% and the maximum limit of 100%. However, if the IRL result is less than 80%, then the IRL measurement is not achieved and will stop at that IRL level.

The following is a visualization of the results of the KATSINOV measurement on the overall aspects analyzed at each IRL level.

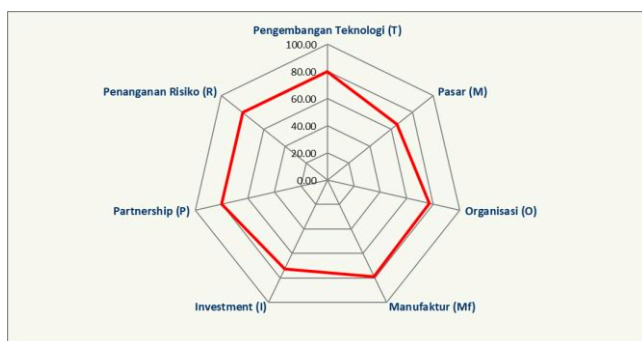


Figure 9. IRL Measurement Chart on Overall Aspects

Based on the IRL measurement graph on the overall aspects above, measurements based on indicators are obtained in the aspect of technology development at 80%, market aspects at 65.71%, organizational aspects at 77%, manufacturing aspects at 78.82%, investment aspects at 72.86%, partnership aspects at 80%, and risk management aspects at 80%. Based on the 7 aspects that have been measured IRL using KATSINOV technological development, partnerships, and risk handling have the greatest results of 80%. While the market aspect has the IRL result with the smallest value of 65.71%.

Aspects of Innovation Readiness Level

After measuring with the Innovation Readiness Level (IRL), there are IRL measurement results based on 7 aspects, namely technology, organization, partnership, manufacturing, investment, and risk. The following is an analysis related to the measurement results of various aspects.

The following are some of the results of the aspects that have been analyzed in the measurement of KATSINOV at each level.

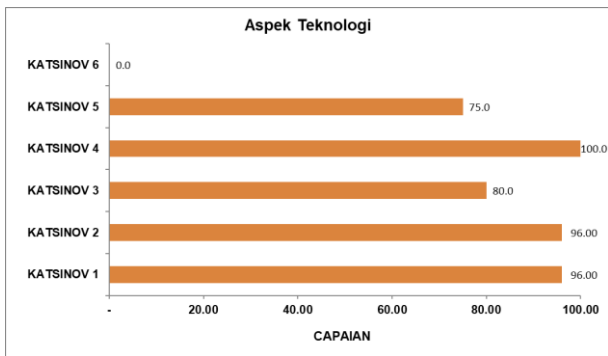


Figure 10. Graph of IRL Measurement on Technology Aspects.

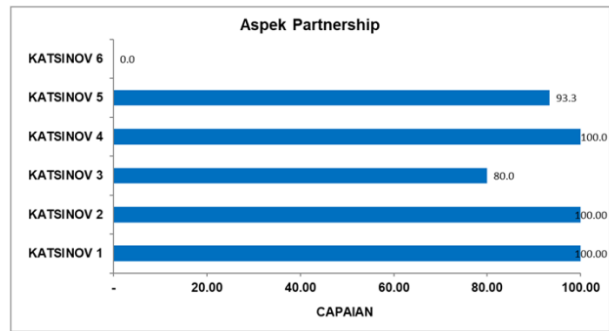


Figure 14. Graph of IRL Measurement on Partnership Aspects.

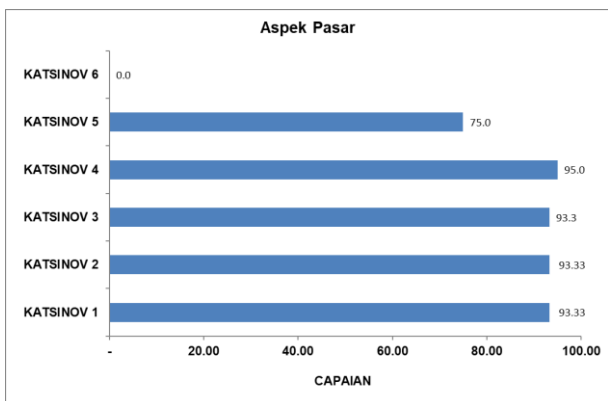


Figure 11. Graph of IRL Measurement on Market Aspects.

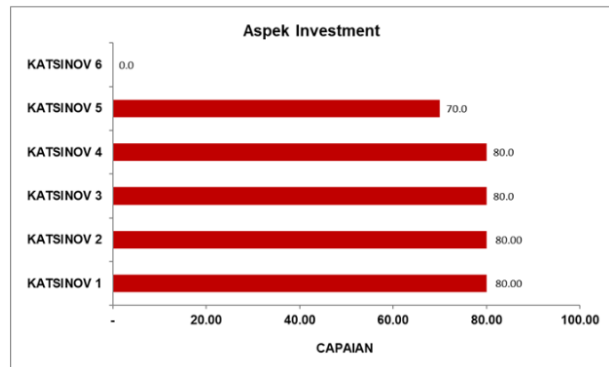


Figure 15. Graph of IRL Measurement on Investment Aspects

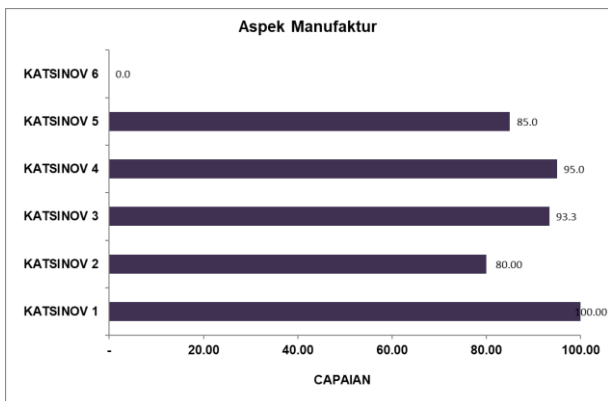


Figure 12. Graph of IRL Measurement on Manufacturing Aspects

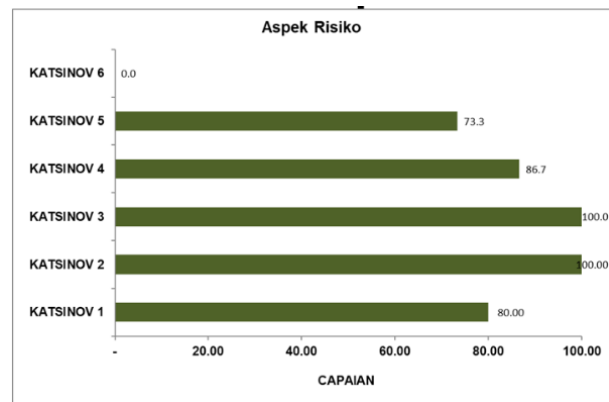


Figure 16. Graph of IRL Measurement on Risk Aspects

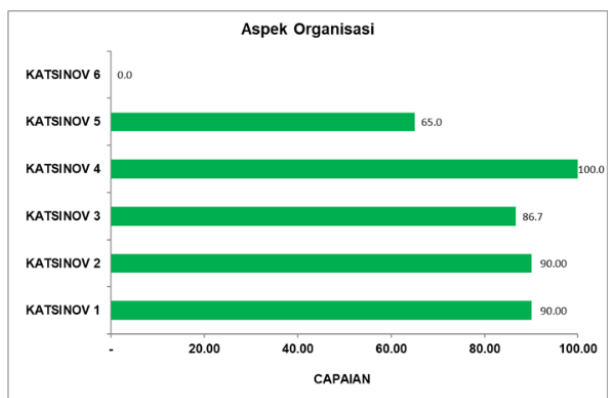


Figure 13. Graph of IRL Measurement on Organization Aspects

Conclusions

Based on research conducted on the analysis of the readiness of innovation of battery-based electric motorized vehicles on GESITS, the following conclusions can be drawn: GESITS G1 Battery-Based Electric Motorized Vehicles produced on KATSINOV measurements stopped at IRL Level 5, where GESITS G1 reached Level 4, namely chasm. The Company's products are still at the end of the cliff which is still not safe if they enter the market.

Based on the results of the IRL measurements that have been obtained, the market aspect has the smallest IRL value of 65.71%. The market or marketing aspect of GESITS can be said to be still not good at marketing GESITS battery-based electric motorized vehicles. The method to improve market aspects is to conduct more in-depth market research to find out the needs and preferences of potential customers.

To identify potential target markets, it is necessary to study the latest market trends and preferences related to Electric Vehicles. GESITS products should be improved and enhanced based on user and potential customer feedback. Research needs to be conducted on the market and prices of comparable electric vehicles. To attract customers, set a competitive price for GESITS. To ensure that GESITS is available in various places, it is necessary to establish an extensive and efficient distribution network. One indicator that is lacking in the market aspect, namely in M6 Katsinov 5, has carried out product differentiation with a score of 2, because the new Gesits battery-based electric motorized vehicle (KBLBB) only has 2 types of electric vehicles, namely the GESITS G1 which was launched in 2018 and the new GESITS Raya which was launched in 2023. Then in the T3 Katsinov 5 market aspect, namely the supply of spare parts for technology products has been provided.

Conflict of Interest: The authors declare that there are no conflicts of interest concerning the publication of this article.

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