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Designing Strategy for Waste Management Business in Cement Company Using Scenario Planning

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KEYWORDS
Waste Management; Scenario Planning; Thematic Analysis; Cement Plant

ABSTRACT
Economic and population growth in the future will increase waste generation and environmental challenges for the Indonesian Government. Cement plants can utilize waste as alternative fuel and raw materials, providing waste disposal services. This research discussed strategies for cement companies to develop their waste management business. Strategic tools called scenario planning are used in this research to create robust strategies facing future uncertainties. This research used a qualitative thematic data analysis from interviews with experts to identify critical uncertainties. The key focal issues are how will regulatory, market competition, and sustainability trends impact development of waste management business in cement company over the next 5 years. This research involved 6 industry experts from different companies, cement companies, government, and regulators. Through interviews and thematic data analysis, driving forces were identified and by using expert ratings, critical uncertainties were defined. The critical uncertainties are regulation and industry competition, which then shaped the four scenarios as the result. These scenarios have implications that impact the waste management industry and cement companies must be able to adapt to the emerging scenario. This research concludes with recommendations for cement company to leverage process efficiency in waste utilization, advocate to government and regulators, utilize branding as environmentally friendly solution to the waste problem, engage in research and development of waste processing technologies, establish strategic partnership with relevant stakeholder, and adjusting focus in terms of investment spending and technology adoption.

Introduction

Indonesia has YoY growth of 5,11% in Q1 2024, significant contribution gained from the industrial sector. Downstream policies by the government mainly in manufacturing are driving the economic growth (Zhao et al., 2021). Growing industries translates to increasing industrial waste

generation. In terms of overall waste generation in Indonesia, only 64% is handled, 60-70% of it dumped in landfills, only about 15% is being recycled (Östensson & Löf, 2017). With the increasing number of waste generation and low percentage number of waste handled, this is a big opportunity for waste management industry to grow in the future.

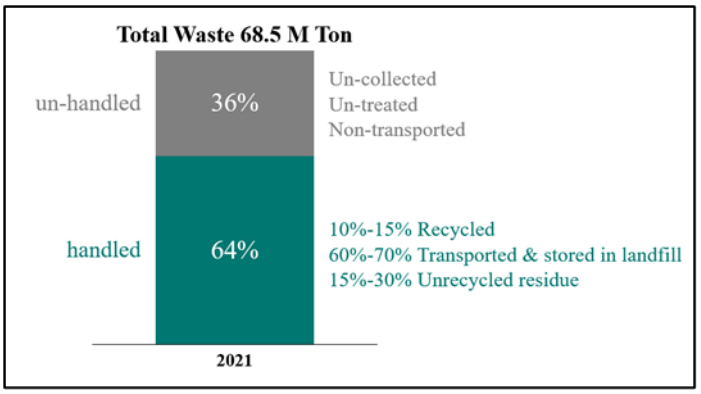

Figure 1. Waste Generation and Handling in Indonesia

On the other hand, the cement industry has been facing an oversupply state for over a decade now. In 2022, there are 116 million tons of capacity and only 63 million tons in demand (Ircham, 2023). The current demand growth simply is not catching the production capacity growth. Cement companies must innovate to compete in the market. Cement production is energy intensive and contributes as high as 7% of CO2 emission globally (IEA,2018). PT Semen Indonesia (Persero) Tbk in 2023 recorded a fuel and energy cost combined for 36% of the total manufacturing cost (PT Semen Indonesia (Persero) Tbk., 2024). It is very helpful for the cement industry to have alternative sources of raw material and fuel to substitute the main material (Abdul-Wahab et al., 2021). Economically, using alternative fuel and raw material sources as substitute material can provide better cost structure (Liang et al., 2023). By embracing utilization of waste as alternative fuel and raw material, the cement industry can achieve better cost, reduce environmental impacts, and build towards a sustainable future.

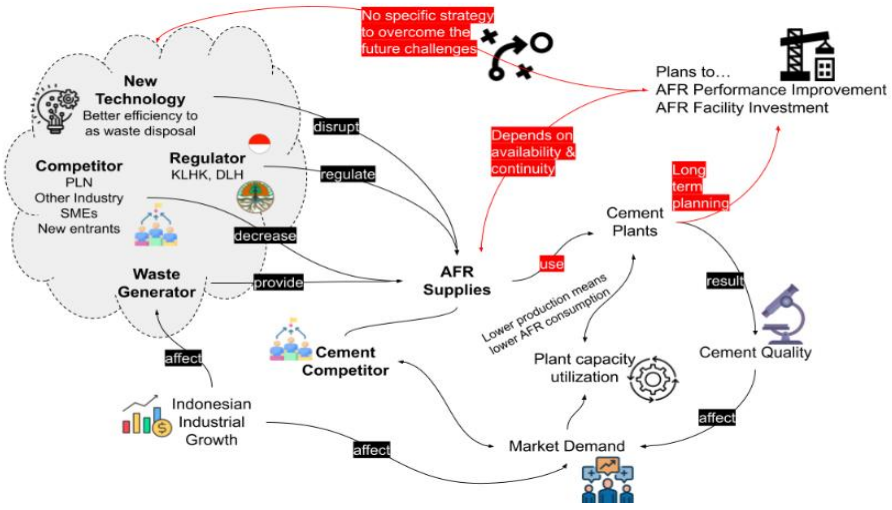

Figure 2. Business Issue

To provide waste disposal services like waste management companies, cement companies need to consider several factors such as plant utilization, facility installed, supply availability and continuity. There are also external factors that possess uncertainty such as regulations, technology advancement, and social factors. To create a robust strategy and facing all external factors, this research will use scenario planning methods. .

Scenario Planning

Scenario planning is a method to explore the possible future outcome and development. It considers more about uncertainty involved in the business industry. The aim of scenario planning is only to depict different scenarios of the futures based on external factors such as new trends, sources, and new competitors (Ghazinoory et al., 2018). There are 5 stages in the scenario planning; orientation, exploration, scenario creation, implication & options, and integration. In the orientation stage, researchers conduct scoping and secondary data collecting. Researchers will define the key focal issues as the basis of scenario planning research. In the exploration stage, primary data collection is conducted using interviews with experts that are the representatives of factors inside the transactional environment (Levakos, 2021). Interview results are processed using qualitative data analysis to get driving factors in the contextual environment of the industry. Each factor in the contextual environment will be assessed by the level of impact and uncertainty (Pan et al., 2023). In the scenario creation stages, 2x2 matrices are created using the critical uncertainties. The results are 4 scenarios with different characteristics of critical uncertainties. Implication of each scenario will be explained along with the strategic options that the user can do to counter the implication. For each scenario, there will be an early warning signal, as an indicator when a scenario becomes likely to occur. In the integration stage, the options for each scenario will be integrated into the business strategy of the user.

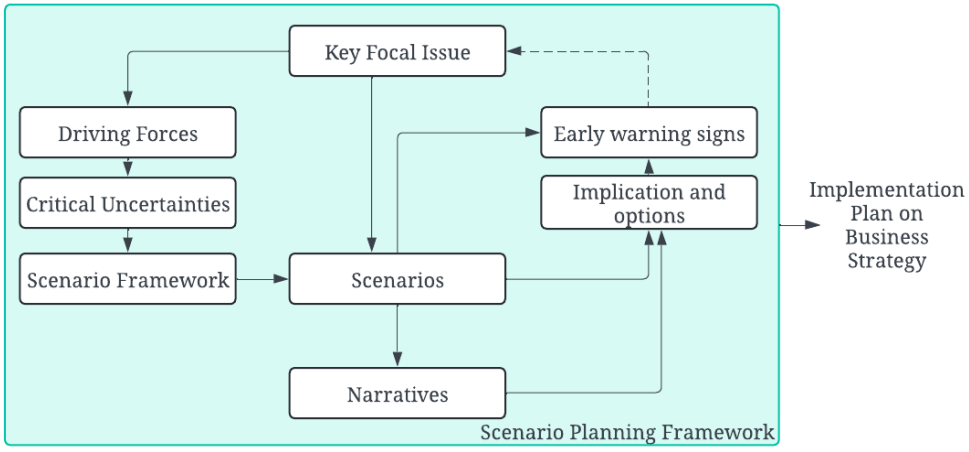

Figure 3 Scenario Planning Framework

PESTEL Analysis

PESTEL analysis is a strategic tool to determine external factors that affect a company or industry. It covers 6 main aspects, Political, Economic, Social, Technology, Legal, and Environmental. Political aspects analyze how the government can influence the business landscape. Economic

aspects discuss dynamic factors that affect business performance, such as inflation rate, raw material price, and demand. Social aspects discuss what event happening in the community and taking it into consideration to affect the business. Technological factors contain innovation that can bring changes and affect the business operations. Legal factors such as regulation, consumer laws, safety standar need to be considered as factors that can affect business operations. Environmental aspects of the business discuss how factors such as geographical location, climate condition, weather, ground conditions can affect the business operations (Buye, 2021). Analyzing a company's external factors using PESTEL frameworks brings many benefits such as finding competitive advantages of business, giving directions of changes, avoiding failure, and helping develop an objective view of the new environment.

Previous Related Research

The practice of using alternative fuel and raw material has been widely used in the cement industry, several research including:

- The emission of CO2 in cement plants can be reduced by increasing the use of AF (Rahman et al., 2013). AF material is either mixed with coal in the coal grinding process or can be directly fed into the preheater.
- The use of AR in mainly mixing the AR during the raw material mix design and grinding process of clinker. The quality of cement (reduction of setting time, increase of compressive strength) can be increased due to increasing number of alternative raw materials used in the production (Hashem et al., 2019)
- Combining cement industry and waste management can potentially reduce greenhouse gas emissions and natural reserve preservation. Replacement of traditional fossil fuel and natural resources with alternative material not only provide better environment but also can reduce cost for cement industry (Usón et al., 2013)

While study about waste management business conducted by cement companies also have been conducted by several researchers, such as:

- (Rachman, 2024) studies the strategic improvement of state-owned companies to accelerate their waste management business. The studies evaluate three strategic alternatives. The results are the creation of a specialized waste management business unit as a form of synergy, giving advantages of independent and more focused operations.
- Nugraha, B.Y. studies about scaling up refuse-derived fuel utilization in cement plants. Since the cement industry is now oversupplied and the company is not in a strong financial condition, the study decided what kind of financing source is the most suitable for scaling up the RDF plant. (Nugraha, 2021)

Materials and Methods

This research uses a deductive scenario planning approach, which follows the scenario planning method (Sunitiyoso & Muhammad, 2024) to structure the research process methodically. Each of the stages is conducted sequentially. It begins with defining key focal issues and actors

within the transactional environment. Expert interviews are used for data collection methods. Table 1 shows the list of respondents based on actors within the transactional environment. The interviews aimed to collect the driving factors in the waste management business. Interview questions made using the PESTLE approach to understand contextual factors within the industry. Interview results then analyzed using thematic data analysis to identify and analyze patterns in data. This analysis provides a systematic approach to complex qualitative data by organizing and describing in detail. Findings will be highlighted as code and carried out systemically for all data sets.

The interviews are transcripted, then analyzed to find keywords. The keywords found will be marked and submitted as code. The codes will be grouped into clusters, which will become the driving factors in the contextual environment. Each driving force is given a rating based on impact and uncertainty level to identify the critical uncertainties. Scenario created based on how two critical uncertainties interacted in a 2x2 matrix. Each scenario will have their own narratives, then implications and options can be defined. In this research, strategy recommendations were created considering cement plants' strengths and weaknesses.

Table 1. List of Respondents

Sources Person	Experience
Industry Expert 1	Head of AFR division of cement plants. Experienced in the waste management industry for 17 years.
Industry Expert 2	Waste management commercialization expert. Specialized in analyzing market and demand especially in East Java. 10 years experience in the waste management industry.
Industry Expert 3	Municipal waste business development expert, especially in relations with local government. 15 years experience in waste management and AFR industry.
Industry Expert 4	AFR marketing and development section head on a cement plant based in West java. 7 years of experience in the waste management industry.
Industry Expert 5	Head of Waste Management Unit in a cement company. More than 7 years experience in the waste management industry
Industry Expert 6	Regional Sales Manager for a waste management company. 10 years of experience in the company.
Regulator	Environmental impact control at the Ministry of Environment and Forestry for 6 years.
Government	Waste-related Environmental Researcher at BRIN, multiple research on waste-to-energy technologies.

Results and Discussion

Driving Forces

Based on the interview result, this research found 70 different potential driving forces which then clustered into 7 driving forces. The presence of strong political power in a company or close relationships with decision-makers could change the competitive landscape in business is then defined as Politics and relations factor. Indonesia's economic conditions can influence industrial activities, which will impact the development of the industry, which is then defined as the Economy and finance factor. The worsening environmental and climate conditions can put pressure on industries that use traditional fuels and mining to reduce their environmental impact and move to

more sustainable operations. These trends can increase demand for using waste as an alternative fuel and material. This factor is defined as the Environmental and sustainability factors. The intensity of competition will increase in the future as there are many new entrants in the form of waste platforms, which is then defined as the Industry Competition factor. Technological advances in waste processing can provide advantages in the form of lower costs for users and give first-mover advantages. New technology can also disrupt the current business landscape. This is defined as the Technology Advancement factor. Regulatory changes can affect industrial waste from two sides. First, with strict regulations, there will be more types of waste that need proper disposal, and this will clearly increase demand in the waste management industry. On the other hand, regulations related to waste management can change the industrial waste business landscape in the future. Increasing waste-related problems and the public trend of sustainability awareness could put pressure on the government and increase demand for waste management services in the future, which is then defined as the Social Awareness factor.

For PESTLE analysis, the author projects the key findings to the PESTLE framework. The result is that the Economy (26%) and Legal (25%) are the biggest factors driving waste management business, followed by Politics (19%), Technology (15%), Social (8%), and Environmental (8%).

Scenario Creation and Implications

There are 7 driving forces identified in the exploration stage. Based on direct ratings made by industry experts, Industry competition and Regulations came up as two critical uncertainties that have the highest impact and uncertainty level, as shown in Figure 4. Those two are the foundation of the scenario creation stage. Scenario creation uses a 2x2 matrix as shown in Figure 5. The scenario is the Green Revolution when strict regulations are met with high industry competition. Monopoly by Design, when strict regulations favoring cement plants met with low market competition. Voluntary Innovation is when industry development is driven by technology advancement of private sectors while the regulations are stagnant. Business as Usual, when both regulations and competition are stagnant.

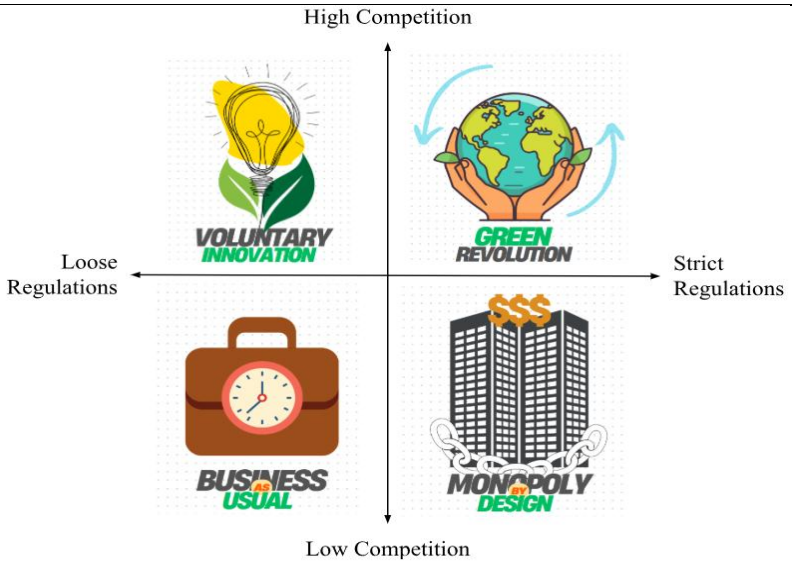

Figure 4. 2x2 Critical Uncertainty Matrix

1. Green Revolution

In the future, the government will highly regulate the disposal of every type of waste generated by industry and municipalities throughout the country. Industries need to register all of their waste generated from the production process, how they dispose of the waste, and eventually, what is the method of the final treatment. The final treatment of waste will be using environmentally friendly methods. Permit operation for waste management providers will be harder to obtain, as the regulators want a more thorough checking in order to make sure the waste is managed properly.

With the orders from the government, the demand for waste management services is rapidly increasing. Industry and municipality will need solutions to manage all waste generated. Current solutions might not be sufficient, new solutions are coming in as companies increase capacity and innovation in waste handling. Waste management players will increase as the demand grows. However, new players will have to overcome a high barrier, as it is harder to get a waste management permit. In the future, new players often bring new technology or innovation to compete with established players. Cement plants have competitive advantages such as efficient processes, high volumes, and live monitored emissions, ensuring waste is demolished properly.

2. Monopoly by Design

In the future, the government will highly regulate the disposal of waste across the country. Industries need to register all their waste generated from production activities and report how it is managed. Ways of disposing waste will also be regulated, to maintain environmentally friendly waste disposal. The government wants to ensure its green initiatives target is achieved. The government sees cement plants as the best method to dispose of waste, so the regulations would favor them. License and permit to operate as waste management providers will create a high barrier of entry, as the government wants more thorough checks for each company, making sure the waste

is properly disposed of. Smaller players or new entrants have challenges to meet disposal requirements because of cost barriers. In other words, the current player will gain control over the monopolistic market.

This scenario is favourable for the cement plants (with existing infrastructure) as a waste disposal services providers because it gives market and price control to them. The demand for waste management services and available waste is increasing, and combining it with control over pricing will lead to high profitability operations for cement plants. However, as the monopolistic competition goes on, it could hold down technology adoption processes in the waste management industry.

3. Voluntary Innovation

In the future, the government will regulate waste handling relatively the same as it does today. The government had strategic initiatives in terms of waste handling in Indonesia, but they have poor execution. For example, poor law enforcement for waste management operations, in the sense that they only do their job based on public reports when they should do it proactively. This will lead to stagnation in national waste handling. Waste generators can look for loopholes in the system; for example, they can store their waste in landfills, reducing demand for waste management services.

On the plus side, the waste management industry's growth will be triggered by the high competition from industry players. Private sectors are aware that waste management can provide them benefits. They successfully launch pilot projects and gain sustained profits. Because of this, the industry started to grow and new players are emerging. Technology adoption is rising. Industry players want to differentiate themselves and reduce costs using new technology. These trends will lead to new types of waste that can be processed, which means new sources of revenue stream for the company. There will be an uneven distribution of waste management practices across the country. Areas with attractive markets will have strong results in environmental benefits compared to others.

Cement plants with existing infrastructure will gain advantages as waste processors. There will be competitive price wars between waste generators. Cement plants will have operational cost and scale advantages. However, because of the intense competition, cement plants will slowly lose their market share. Disposal prices will decrease, impacting the profitability of their waste management operations. Cement plants will have to innovate and adopt new technologies in order to maintain their competitive advantage.

4. Business as Usual

In the future, there will be no development of new regulations that can tighten waste management practices, no addition of waste type, and no status change of waste. Law enforcement also had no significant development, as the authority was still using old practices in enforcing the law of waste management. The rate of handling waste will be relatively the same as today. Regulations and weak law enforcement make the waste management industry not attractive to new entrants, as they will be faced with high entry barriers of political power and cost. Competitions

inside the industry will be limited to the established companies and cement plants. Low competition inside the industry will also hold innovation and technology adoption. Hence, the waste management industry will continue to rely on landfills and current methods of waste disposal.

For cement plants, the volume and type of waste available as alternative raw material is relatively stagnant, making profitability stagnant and having no significant growth. Because the competition in this industry is weak, there is no pressure to increase capacity or adapt new technology for cement plants. Low technology adoption also impacts the capability for cement plants to use new sources of waste as alternative raw material, hence the stagnant volume and type of processed waste.

Early Warning Signal

Early warning signal is identified to help monitor trends, events, or changes to indicate which scenarios is becoming likely to occur. For the Green Revolution scenario, new stricter regulations emerge, the development of new landfill areas will be prohibited, so there must be a new final disposal method. Competitors have successfully carried out pilot projects and there are many new facilities installed in more than 75% of industrial areas. Public awareness increases regarding waste problems, increasing demand. Due to the large number of competitors, there will be a 50% decrease in average revenue per ton of waste and waste utilized is decreasing. There are 1 or more new technologies successfully used per year. Massive investment in developing waste management infrastructure.

In Monopoly by Design, the signals are that new stricter regulations emerge favoring cement plants with subsidies for established players. There are partnerships among dominant players and a campaign from cement plants as waste solution providers. For companies, increased average revenue per ton of waste processed. Increasing waste utilized in cement plants but moderate investment in new technology, with emphasis on improving current facilities.

In Voluntary Innovation, no new regulation emerging, but competitors have successfully carried out pilot projects, many new facilities have been installed in more than 75% of industrial areas, and growing partnership between generators and processors. Public awareness also increases, increasing demand. There will also be a 50% decrease in average revenue per ton of waste due to the large number of competitors. High innovation and technology adoption in waste processing technology, thus increasing the final disposal method.

In Business as Usual, there is no regulation development and stagnant industry growth, making it harder for companies to attract investors. Waste utilized in cement plants and the method of final disposal are stagnant because there is no new technology or innovation.

Table 2 Early Warning Signal

Signal	Green Revolution	Monopoly by Design	Voluntary Innovation	Business as Usual
Regulation	New strict regulation	New strict regulation favors cement plant	No development	No development
Policy	New landfill	Subsidies for	No development	No development

	banned	established players		New landfill allowed
Competitor	Successful pilot project using new tech new facility installed in 75% industrial area	Partnership among dominant players	new facility & platform installed in 75% industrial area growing partnerships between waste generators and processors.	stagnant industry development, still dominated by the current player
Public Awareness	Increasing public awareness related to waste problem	Campaign from cement plants as solution provider	Increasing public awareness related to waste problem	No campaign
Waste Business unit revenue	50% decrease in average revenue per ton of waste processed	Increased average revenue per ton of waste processed	50% decrease in average revenue per ton of waste processed	stagnant
Waste utilized in cement plant	Decrease	Increase more than 25%	Stagnant, tends to decrease	stagnant
Technology adoption	More than 1 new technology per year	Rare new technology	More than 1 new technology per year	none
Investment	High investment in new facility development and technology adoption	medium investment spending	high investment, especially in new technology	low, hard to attract new investor
Disposal Method	Increased option of disposal method	Current method with improvement	Increased option of disposal method	Current method

Strategic Imperatives

Considering scenario implications, cement plants strength and weakness, strategic imperatives for cement plants are created. The results are a robust strategy for cement plants to develop their waste management business and face the future, as shown in Table 2. Cement plants strategic imperatives are leverage cost efficient process as waste disposal method, promotes environmentally friendly operation, advocacy to regulator, embrace green operation branding, launch waste management awareness campaign, embrace research and development to develop new capabilities, and establish partnership with different stakeholder and actors within the industries.

Some strategy aspect needed to be adjusted considering the scenario that's happening. For Green Revolution, conduct advocacy to gain advantages, aggressive investment and technology adoption. For Monopoly by Design, the focus is to scale up and standardization over innovation. Advocacy conducted to maintain advantages, moderate investment and passive technology adoption. For Voluntary Innovation, the focus is to capture market through collaboration.

Advocacy is conducted to gain advantages, investment mainly through partnership and moderate technology adoption. For Business as Usual, the focus is to optimal waste utilization to support cement production. Advocacy is conducted to develop stronger regulation, while investment and technology adoption is passive.

Table 3. Strategic Imperatives

Strategy	Green Revolution	Monopoly by Design	Voluntary Innovation	Business as Usual
Focus	Leverage advantages through technology and innovation	Scale up and standardization over innovation	Capture market through collaboration	Waste utilization to lower production cost
Operation	Leverage cost efficient process	Maintain efficient process while scale up	Leverage cost efficient process	Maintain cost efficient
Branding	Promotes environmentally friendly operation, embrace green operation branding, launch waste management awareness campaign			
Advocacy	To gain advantages	To maintain advantages	To gain advantages	Advocate for stronger regulation
Investment	Aggressive	Moderate	Through partnership	Passive
Technology Adoption	Aggressive	Passive	Moderate	Passive
Research & Development	Embrace research and development to develop new waste processing capabilities, increase operational efficiency, and create new waste-based product or services			
Partnership & Collaboration	With local government (i.e. MSW to RDF projects) With waste processing platform to create regional hub to maintain supply With ministry agency to support waste related initiatives With local environmental services, to support with waste related problem and gain trust			

Conclusion

Key focal issue in this research is how will regulatory, market competition, and sustainability trends impact development of waste management business in cement company over the next 5 years. By using scenario planning approach, this research identifies seven driving factors, two critical uncertainties, and four create scenario for future waste management industry that constructed by combination of industry competition and regulation.

Green Revolution scenario describes when the stricter new regulation and increased competition is rising. Monopoly by Design describes when stricter regulation favoring cement plants is emerging in low industry competition. Voluntary Innovation describes when industry competition is driven by innovation and technology development but no development in regulations. Business as Usual describes when the current state of regulation and industry competition is stagnant.

With the narrative of each scenario, companies can describe future implications and options for them on facing the challenges. Several strategic imperatives for cement plants to compete in the future are leverage efficient process, advocacy to regulator, promotes environmentally friendly

operation, embrace research and development, and establish strategic partnership. These robust strategies should be conducted by cement company to face the future of waste management business in Indonesia. Early warning signal is monitored through several aspects such as regulation development, public awareness, and technology adoption. Strategy aspect such as investment and technology adoption should be adjusted based on the scenarios that are likely happening. These strategy and scenario planning can only be implemented in Indonesia for cement plants that are developing their waste management business.

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