The Role of Cleantech Startup in Green Economy Development

Riswanti
UIN KH. Abdurrahman Wahid Pekalongan
Email: riswanti@gmail.com

Abstract

The role of startups in advancing innovation and green economic growth in Indonesia is becoming increasly important. Cleantech startup is the one of the major business players in green innovation and technology, which is based on utilizing or generating clean energy. This literature study will discuss technological innovations and ideas around sustainability and the environment and the collaboration from related parties. This study uses the desk review of mayor articles from reputable journals. In addition, technology development and licencing alliances will affect the pattern of financial investment. Many investors are starting to be interested in investing in green companies that offer promising solutions. The main focus in sustainable business model in environmental issues such as waste and resources. The finding in this study need to be studied more deeply by research and another supporting historical data.

Keywords: startup, cleantech, green economy.

A. Introduction

Cleantech Startup has become a priority in public policy targets around the world, and Indonesia is no exception. Currently, Indonesia is intensively contributing to reducing pollution levels and increasing innovation levels that are more environmentally friendly,where this is in accordance with the Paris Agreement which was signed in 2015[1]. Green innovation (green innovation) develops the characteristics of a product or service by considering energy efficiency, substitution of materials that are more environmentally friendly, design modifications or features to make them easier to recycle[2]. Environmentally friendly innovation or so-called Green innovation is inseparable from the technological innovations carried out.

Most of these green technology innovations involve supporting facilities such as laboratories, expert resources, strong market research, and long-term financial support [3]. This series of support is inseparable from the role of stakeholders involved in green innovation carried out by Cleantech Startup in relation to agro-industry. Green innovation -especially those carried out by Cleantech Startups- can be categorized as radical innovations, therefore the strength of business networks and comprehensive collaboration with research and government institutions is needed to support the success of potential and sustainable green innovation products[4],[5], [6].

Strong participation from the government, cooperation with large private and government companies, and research and training assistance from educational

and research institutions will be key factors in the strength of the network owned by Cleantech Startup, this network will affect the utilization of resources owned by Cleantech Startup so that it can continue to carry out green innovation[7].

Government policies to reduce pollution and encourage industry to be environmentally friendly, create certain patterns of interaction between government and private actors in various sectors[8]. It is still being debated that Cleantech Startup with funding from the government and the private sector has different process characteristics and sustainability outcomes[9].

Collaboration between Cleantech Startup and universities and/or research institutions takes the form of both short-term and long-term projects, where universities and research institutions play an important role in the transfer of knowledge related to green innovations such as the use of simulations and 3D printing to address emissions and pollution issues. 10]. Meanwhile Cleantech Startup also needs to collaborate with the market -especially consumers and suppliers- to be able to improve the performance of environmentally friendly product innovations that require strong research and development studies as well as field studies. Among them are improving energy efficiency, reducing the use of non-recycled materials, minimizing fuel use, minimizing the use and transfer of toxic materials during production [11], [6]. All of these activities are classified as disruptive transformations and will affect the organizational typology and Cleantech Startup business model.

This article is composed of 5 (five) parts. The first part is the background of this desk review article. Then, the second part contains a brief explanationabout Cleantech Startup and green innovation, the urgency of the TH collaboration network for startup business model patterns in general, and how the basics of a sustainable Cleantech Startup business model are. Furthermore, the third section contains the methodology used. The fourth part contains the analysis and discussion which in conclusion (the fifth part) will produce a Cleantech Startup business model based on Cleantech Startup green innovation by considering the Tripple Helix collaborative network.

B. Method

Cleantech Startup is oriented towards production and commercialization using technology based on “limited or zero non-renewable resources” where the goal is also to reduce waste and be environmentally friendly [15]. Cleantech addresses environmental problems using new science, through innovations that can increase productivity and efficiency in different business processes [16], [17]. It can be seen that Cleantech Startup currently covers many products, services and technologies including: recycling technology, renewable energy (wind power, solar power, biofuels, hydropower, and biomass), information technology, green transportation, electric motors, green chemistry, materials composites, and lamps/lighting. In answering the problem of the climate crisis, Cleantech Startup is a promising business that attracts a lot of investment and creates jobs. Therefore, special intervention from the government is needed to support the successful development of Cleantech Startup in business ecosystems, especially sustainable business. The need for government intervention is rooted in the unique

nature of the cleantech business, which makes incentives and tailored regulations (e.g., anti-pollution norms) a fundamental prerequisite for business development.

There are three urgency related to Cleantech Startup. First, environmental resources are public goods. As a result, consumers are generally less likely to pay for clean technology products and services because they receive only a fraction of the benefits. Second, many government actors are making efforts to reduce environmental degradation plus supranational organizations for environmental protection promulgate international agreements and enforcement protocols (eg the Kyoto Protocol, the Montreal Protocol on CFCs, and the European Union Emissions Trading Scheme). This fact reinforces that the international context influences the strategy of clean technology companies (cleantech). To encourage sustainable industrial development, countries around the world must coordinate with each other on environmental policies and comply with the international agreements and protocols mentioned above. Third, in the case of clean technology companies, market failure due to the nature of green business is coupled with market failure which is related to the nature of the high-tech industry. Plus the lack of government intervention led to the investment of clean technology companies in Ra technology development and diffusion of environmentally friendly technologies is less than socially optimal. Green innovation -as a key factor in achieving environmental protection and resource saving- has been of great importance to achieve long-term development and competitive advantage in recent years. Green innovation includes green product innovation, green process innovation, green technology innovation, green service innovation, green organization innovation where all of these things will contribute to a green environment [20],[21],[22].

Clean technology innovation is defined as an umbrella term for technologies, processes or products aimed at achieving cleaner production, improving environmental performance and promoting the comprehensive utilization of resources and energy. This characteristic is very close to what is done by Cleantech Startup [23], [15]. Startup companies collaborate with various partners in green innovation. For example, suppliers, customers, universities and research centers are among the leading partners identified for green product/service innovation [24],[10]. Sharif & Monday [25] in their research identified the acquisition of expertise, collaboration networks, and external knowledge links as important in green product innovation. All of these aspects are related to external collaboration where companies access knowledge and build networks. So it can be said that innovation efforts seem to be related to networking activities [14]. In green product/service innovation, customers can contribute in providing information about what is needed and this relates to future market needs [26].

Several previous studies have shown that companies have collaborated extensively with customers and suppliers on green product innovation but lack networking with other collaboration partners (such as larger companies, governments, etc.). Even though the university is a source of external knowledge that can strengthen the adoption of green technology for companies that are aggressively carrying out green innovations such as Cleantech Startup [27]. To

support green innovation in Cleantech Startup, the government also sets pollution tax rates with different amounts at each level [28].

Cleantech startup collaborates with external organizations to access knowledge in order to be able to use new and complex technologies in the green innovations that are carried out [27]. Green innovation differs from ordinary innovation in that partnerships with external organizations almost always play a central role in them. Previous research also shows that collaboration seems to be more important and needed in innovating environmentally friendly products than other types of innovation [22].

Studies show the benefits of integrating partners in green collaboration. Closer relationships with partners can result in improved environmental performance [29]. Close collaboration in innovation partnerships involves direct communication, exchange of knowledge in development efforts and close coordination between partners [30]. When collaborating with other actors, Cleantech Startup needs to coordinate specific activities, decide on the level of interaction, and the mode or type of coordination [31].

Green innovation involves multiple actors collaborating in public-private partnerships. Buildand being part of such a vast network requires resources and commitment [32],[31]. Companies also need to have a long-term perspective, because the benefits of this network collaboration take a long time to materialize. In addition, company size must also be considered because it is related to the company's ability and speed to carry out continuous green innovation [33], [28], [21].

By collaborating with customers and suppliers on product innovation, companies can make a number of distinct environmental advantages from their new products [34]. These advantages include increased energy efficiency, reduced use of materials, reduced mixed materials, reduced fuel consumption, improved handling of toxic materials, increased company performance in implementing environmentally friendly through digitization [34],[29],[35],[31] .

Companies, and CS is no exception, can improve resource utilization by extending product life through repair, maintenance, reuse, and product remanufacturing. To be successful in recycling production, it is important to have a program that encourages customers to trade-in their obsolete products for recycling, which can also be translated into agreements with customers to take back old goods and exchange them for new ones [33]. With this program, the company will also be responsible for the waste or waste pollution it produces [21]. Collaboration can enable companies to conserve raw materials, improve waste disposal, limit pollution emissions and reduce energy-transport-packaging consumption.

Cleantech Startup can also collaborate to influence each other and change the behavior of each actor to be more environmentally friendly. On the other hand, CS also collaborates with supplier-consumer-community to educate and encourage more sustainable behavior and values [36],[31]. According to Song & Wang [28], from the results of research on TH collaboration, vertical collaboration with consumers and suppliers is more effective for product development innovation than doing horizontal collaboration with research

institutions and the government. It is also associated with the mutual speed between the two sides. The concept of collaboration networks in green innovation can be seen in Figure 1.

Figure 1. Collaboration Network In Green Innovation

In the conventional business canvas model, it is possible to see profit from various aspects, but the projected profit still does not consider environmental and social aspects. On EcoCanvas, social and environmental aspects are reviewed in more detail and further linked to business projections. This is very suitable when applied to Cleantech Startups whose characteristics are towards sustainability. EcoCanvas adds 3 important strengths that were not previously discussed in conventional business canvas models [41]. The 3 important strengths are:

a. Aspects of current and future economic conditions and legal challenges related to regulation, market innovation, macroeconomic issues related to company risk. Government regulation is very important in the success of green innovation and sustainable business. Fernando [30] argues that green innovation is important in integrating standard environmental criteria into policies and facilitating companies to have access to investments in infrastructure development through loans and grants. Technological risks also arise due to the lack of technology to reduce carbon emissions, and the costs that come from generating electricity based on fossil fuels. These challenges affect market rules and operating systems, which of course leads to a transformation of the overall business model. It can be said starting from the relationship between cost structure and sources income to finally affect aspects other.
b. Aspects of current and future environmental challenges future such as water shortages, climate change, pollution, environmental threats that can have a direct impact on business supply chains and production or logistics activities. Environmental challenges -for example water scarcity- will impact on the increase in water demand and this will affect several aspects of the company's strategy. These aspects are key resources, key partners, problems/solutions, and cost structures [47].

c. Aspects of social and technological challenges today and in the future. Examples include digital technology, manufacturing, and cultural changes that will shape the values, beliefs, and behaviors that customers experience over time. This led to important changes in Stakeholder Relations, Networking and Sales, and ultimately to sources of revenue [48]. Therefore, environmentally friendly business activities are very important because companies face internal and external pressures originating from employees, customers, environmental agencies, and government agencies. El-Kassar & Singh [49] show the relationship between stakeholders who can represent as barriers or drivers, and organizational mechanisms in dealing with climate change challenges and opportunities. It can be concluded that the needstrengthen the collaboration between them because their interdependence relationship.

EcoCanvas provides us with an opportunity to address the weaknesses of both conceptual approaches, namely the concepts of sustainability and the circular economy, by placing a focus on personalization and rethinking how the economy, society and environment are integrated into specific businesses and contexts50. EcoCanvas coherently enables businesses to create a unique, circular value proposition from a lifestyle perspective. This allows organizations to rethink the circular economy and incorporate environmental and social aspects "by creating a methodological approach to help businesses become more sustainable with the new circular economy paradigm" [49]. EcoCanvas is also intended as a tool for companies and entrepreneurs that can be seen visually integrating circular economy strategies into the company's business. This tool is tailored to users who want to reconceptualize their current business model or find and communicate potential innovations that are sustainable and circular [49]. To highlight and clarify the practicality of EcoCanvas, this paper describes the main features and elements of the model through a detailed analysis of the Cleantech business model.

This research uses literature study method. Literature study is a method that can be applied to formulate a model or framework for a phenomenon in a relatively short span of time, by synthesizing several important previous findings that are in accordance with the characteristics of the phenomena observed . A number of selected articles have been searched through a search system with keywords such as "cleantech startup" or "green innovation" or "green economy" or "eco canvas". The search results show that more than 158 articles appear that match the keywords. However, after being selected through abstract-method-finding- and updates, only 21 articles could be continued for further analysis. this study.

The research instrument in this study is the business model that exists in Cleantech Startup "Xurya Daya" and "Waste4Change". This study also raises case studies of Cleantech Startup Indonesia, namely: "Xurya Daya" and "Waste4Change". These two Cleantech Startups were chosen because they are more than 2 years old and have received a lot of funding. In addition, the two Cleantech Startup have collaborated with the community, government, and similar and conventional companies. Case studies are carried out through desk reviews.

C. Discussion

Business Model Canvas on Cleantech Startupbased on Green Innovation

EcoCanvas is a business model concept that aims to facilitate the user experience while creating a circular value proposition, as there is greater awareness on the part of organizations of the current (and future) economic and legal, environmental, and social challenges, prompting them to start preventing and reduce their impact. From a human capital point of view, EcoCanvas can be used by organizations to better internal operations.

Through a series of circularization strategies, this EcoCanvas helps in defining the main features of a circular business model. Many sets of actions throughout the winemaking process can be implemented to transform a business into a more circular and sustainable one. However, in this particular case study, it was decided to address the energy aspects resulting from new technologies and waste treatment. So far, there are many large tracts of land that have disturbed or ended up being landfills, even though this is a prospect for the establishment of clean technology installations and smart waste processing. This can be valued into something more valuable, for example, wastewater can be treated and reused for irrigation or cleaning, agricultural and household waste can be used to produce gas, energy, and compost, large fields can be turned into smart grids so they can produce alternative energy sources. By looking at this potential, it is important to be able to identify EcoCanvas with Cleantech Startup.

In accordance with the research conducted by Daou et al [41], from the Cleantech Startup CS case above, it can be seen the positive impact of green human resource management on organizational performance. From an economics perspective, EcoCanvas can help organizations and their partners to reduce costs, improve and improve processes, create value and potential new markets. From an environmental perspective, the benefits of using EcoCanvas are manifold. This tool allows organizations to minimize their environmental footprint, and work towards alternatives that reduce harm or even increase positive impact. Finally, keeping in mind the holistic perspective of EcoCanvas, this tool can be used by multiple players in a simple and efficient way, besides this model is also used by businesses to be environmentally friendly and achieve great business sustainability.

Cleantech Startup Green Innovation Influenced by Tripple Helix Collaboration

1. “Xurya Daya” Cleantech Startup Case Study

Xurya Daya is a renewable energy startup in Indonesia that pioneered the No Investment method to switch to solar power. At its core, Xurya Daya is a platform that provides added value to both roofing owners and EPC contractors. Xurya Daya is a partner in meeting solar power needs, starting from investment feasibility studies, providing access to low-cost green-financing to switch to solar power, providing equipment sources/suppliers, construction/licensing management. Cleantech startup Xurya Daya received funding from a number of

investors, namely New Energy Nexus (Indonesia 1), Schneider Electric and Crevisse Partners. This funding adds to the list of investors who are committed to accelerating the implementation of the new renewable energy transition in Indonesia through Xurya.

Xurya will allocate this funding to expand access to green financing for rooftop PLTS installations in Indonesia. Xurya Daya Indonesia Managing Director Eka Himawan said New Nexus Energy, Schneider Electric and Crevisse Partners have a lot of experience in investing in the social and environmental fields. The three investors have diverse portfolios in early-stage renewable energy investments, such as New Nexus Energy Indonesia which in the first half of 2021 has completed its investment in four solar panel companies in Indonesia. To date, Xurya has carried out more than 40 PLTS Roof installations from various industries and businesses, such as cold storages, global logistics companies, ceramic factories, textile factories, steel manufacturing plants, shopping centers to hotels spread across Jabodetabek, Banten, West Java. , East Java, Palembang, to Makassar.

2. Waste4Change Case Study

Waste4Change is a Cleantech Startup solutions for responsible waste management services. Waste4Change is said to not only provide waste transportation and sorting services, but also strategic services for companies. Waste4Change cooperates with Bank DBS Indonesia to work together to make this happen. The number “4” in the name Waste4Change includes four basic things that the company enforces. These include consulting, educational campaigns, collecting waste, and efforts to convert waste into recycled materials. Waste4Change started a business by participating in DBS Foundation programs such as business workshops, social entrepreneur assistance and business coaching. In 2018, Waste4Change has worked together as a waste management vendor for Indonesia,s DBS Bank.

The company, which was founded in 2014, has managed a waste management system and provided education to residents about waste management. Already more than 1,700 homes and large companies have become Waste4Change partners. The hallmark of Waste4Change is the use of the Zero Waste to Landfill method. Waste segregation is carried out from the source, ensuring that everything is processed without being sent to the Final Disposal Site (TPA), and that there is a comprehensive report on the flow of waste. Apart from supporting education, consultation, transportation and recycling of waste, currently Waste4Change is also developing a smart city platform for more efficient and responsible waste management and the wise use of clean energy.

From the two cases above, it can be seen that financing, cooperation, commitment of each party, and government regulatory support play an important role in green innovation and the development of green technology in Cleantech Startup. Technology development without financing (eg investor assistance) and government regulation (eg signing of the Kyoto agreement), will be difficult. As a start, the two startups also look at the problems that exist in society first and then try to find environmentally friendly solutions. These facts are in accordance with

several previous studies [50], [48].
Other results also indicate that digitization, connectivity, and big data are important parts of conducting business processes in Cleantech Startup. It can be seen that Xurya Daya CS has a base where to install big data components from the installed Smart Grid. Apart from that, Cleantech Startup Waste4Change also uses a digital platform to be able to record what types of waste and how the recycling process can be carried out. These technologies help the utilization of company resources and streamline the movement of green innovations [45], [31].

Both of these Cleantech Startup have been running green innovations for more than 2 years. From the company profiles listed on the website, both of them have collaborated with universities and surrounding communities to carry out green innovations aimed at obtaining clean (green) energy. Collaboration with universities is carried out through external funding schemes such as foreign grants and domestic grants initiated by related universities. The form of cooperation can be multiyear or annual. For multiyear collaborations, Cleantech Startup - University usually also partners with related large industries, usually intended for mass production of the results of green innovations that have been carried out.

Cleantech Startup in developing its technology -such as Xurya Daya & Waste4Change- also considers the trends that occur in society. The momentum for the development of green technology also involves the adoption of the technology. This technology adoption is also carried out with business experiments in the form of: Selling business experimentation through trialing; customer-driven business experiments; and a sustainable value-driven business experimentation.

Business experiments through selling the business with trials were carried out by Cleantech Startup through the resulting prototypes. In this type of experiment, it can also be seen whether green products/services are good enough or fail. Then, from these trials, usually comments from potential customers will be considered for technology development. This type of customer-driven business experiment can be implemented through a pilot project in a community. From the community is intended to establish or strengthen the value of green innovation. Through this business experiment method, green technology adoption is also developed by way of open innovation where innovation is carried out by involving local community actors and knowledge exchange is carried out. Meanwhile, business experiments using sustainable value-driven, intrinsic value will be formed from business value that is carried out in the long term. This method will also be implemented by combining regulatory and political aspects in the long term. This fact is also in line with what was revealed by Song & Wang [28].

D. Conclusion

Business experimentation is known to strengthen the circulation of green innovation because it pays close attention to existing problems in the field and consumer expectations. This sustainability direction looks at what a circular economy produces. The proposed EcoCanvas has implications for circular economy and business model theory and practice. This study responds to the gap

in the literature for a deeper understanding of the relationship between the circular economy and sustainability, and the specific influence of the two concepts on the performance of the business model. EcoCanvas' circular economy model creates value that allows this study to redefine sustainability and integrate environmental and social aspects along with economic dimensions. In addition, this study also sees that the results of Tripple Helix's collaboration with Cleantech Startup will affect the form of the Cleantech Startup business model towards sustainability (or what is known as EcoCanvas).

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