Towards circularity in European countries and Indonesia

A comparative case study of the implementation of circularity and innovation in European countries and Indonesia

Graduation Thesis

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Abstract

Background, issues, and main research questions

Circularity (circular economy) is being developed in many countries around the world where it has been set as a development goal (Schröder et al, 2019). However, the progress in implementing circularity varies from country to country. Most of the countries that are leading in circularity are European countries (Construcia, 2020). The Global South is less advanced than the former, but the development of circularity is necessary and urgent for the Global South. For example, in Indonesia, where lagging industrial development and high levels of waste generation are currently causing problems such as industrial depression, environmental pollution and threats to human health, the implementation of circularity can help sustain and promote industrial development and address the problems caused by growing waste (Preston & Lehne, 2017). At the same time, in the face of the current global problem of increasing resource consumption, the implementation of circularity has been identified as an important goal not only for regional development, but also as a common priority for global development (Circular Economy Action Plan, 2020). In this context, this study therefore aims to investigate how to accelerate the implementation of circularity in the Global South and European countries. Specifically, the study decided to conduct a comparative case study between several European countries and Indonesia. Furthermore, innovation related to circularity is included in the theme of this study. The main research questions are therefore how circularity/innovation has been or is being implemented in European countries and Indonesia, what are the distinctive characteristics behind the implementation, and what recommendations can be made for the development of circularity/innovation in Indonesia and European countries.

Methodology

It is a literature-based study. A multidimensional perspective, entailing the levels of the state, civil society and individual enterprises, is the main research approach of this study. Furthermore, the functioning and rules of Systems I and II (Kroesen et al, 2020) provide theoretical and conceptual support for the entire study. Three cases (biogas technology, circularity of plastics, and innovations in the pulp and paper industry) were selected for this study, corresponding to three selected European countries (Finland, Germany, and Sweden) compared to Indonesia. Three main steps were established to conduct this study. Firstly under each case, the selected European countries and Indonesia were subjected to their respective case descriptions and analyses. A comparative analysis and discussion of the selected European countries and Indonesia was then carried out under each case. Finally, corresponding conclusions and recommendations were drawn for the implementation of circularity/innovation in Indonesia and the selected European countries.

Results, conclusions and recommendations

Towards circularity/innovation, a transition is taking place between System I and System II, with both the European countries and Indonesia in this study navigating through it. This study shows that the European countries' distinctive characteristics in terms of circularity/innovation are close to those of System II, independent of those of System I, while a large number of Indonesia's distinctive characteristics in terms of circularity/innovation lack to some extent those of System II, and in addition, some of Indonesia's distinctive characteristics are close to those of System I. The distinctive characteristics of System II are of key importance for the implementation of circularity/innovation, as progress in implementing circularity/innovation is positively correlated with the extent to which countries make the transition to System II.

The efficiency and effectiveness of the state, civil society and individual enterprises in implementing circularity/innovation has been positively demonstrated in the European countries studied. There is a beneficial interaction between state policies with a high level of scientific and technological research and civil society and individual enterprises with a high level of initiative and planning, thus facilitating the implementation of circularity/innovation. However, in Indonesia, although the state, civil society and individual enterprises were all involved in the implementation of circularity/innovation, the interaction between them was less efficient and effective than the former, as unclear vision-setting and over-intervention by the government, poor citizen behaviour and a lack of local initiatives and planning may have hindered the interaction between the various levels when it comes to circularity/innovation, as was observed to some extent.

The following are three particular examples of conclusions and recommendations. In the European countries studied and in Indonesia, open cooperation and complementary relationships between multiple stakeholders in the product supply chain, as well as the openness of customers to accept circular innovative products, are reflected in a more effective implementation of circularity (1). Based on the experience of the European countries studied, the state leaves the space for initiation and implementation to civil society and individual enterprises, while policy development is strictly focused on R&D, which could serve as a reference for more effective implementation of circularity/innovation in Indonesia (2). Indonesia, which is to a large extent close to System I, is at risk of excessive state intervention and over-dependence of stakeholders on relationships, while for the European countries studied, which are close to System II, there may be a risk of too much corporate individualism and liberal behaviour at the expense of the role of the state. Thus, the role of Systems I and II in the implementation of circularity/innovation is not black and white, but more or less so (3).

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1.Introduction

1.1 Background

1.1.1 A short introduction to circularity

Circularity is an approach that focuses on the recovery and reuse of resources and aims to enable a sustainable flow of resources (EMF, 2020). Materials and energy are central to the application of this approach to circularity (EMF, 2020). Even if circularity solutions come from a conceptual origin, relevant practical strategies and implementation methods are found in socio-technical systems (STS). Some typical circularity strategies are described below.

The 3R principle (i.e. reduction, reuse and recycling of resources) is a classic circular theoretical framework, usually applied in the field of waste management (EMF, 2020). McDonough and Braungart (2010) proposed another general circular framework, which includes concepts such as Narrow (i.e. use less), Slow (i.e. use longer), Close (i.e. use again) and Regenerate (i.e. make clean). Bocken et al. (2016) applied this circular framework to the study of sustainable business models. In the paper by Konietzko et al. (2020), circularity is used to study systems rather than individual products or services, where the range of components and relationships contained in the system is greater than the range of products or services. This indicates that the focus of circular innovation has been shifted from a single product to a system. The following figure shows the general circular framework.

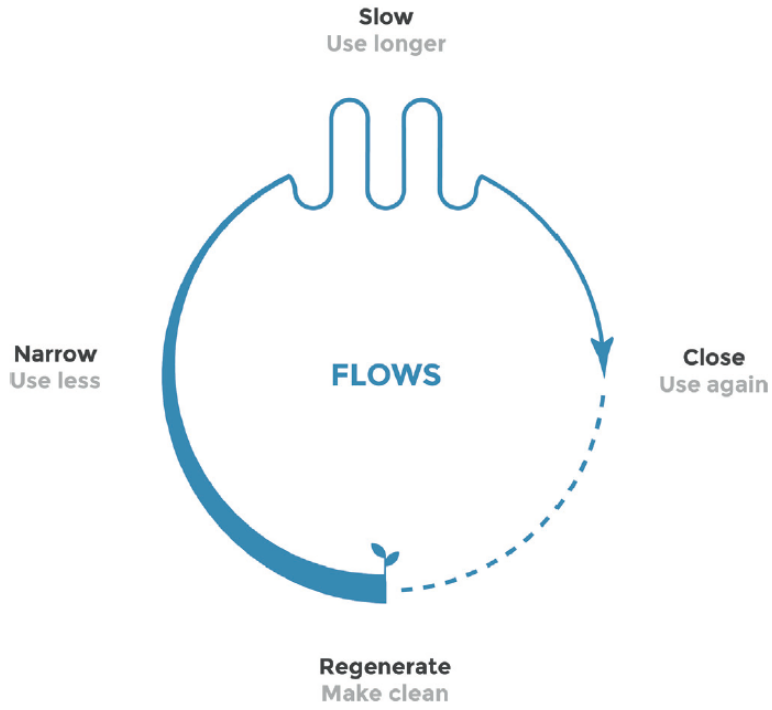


Figure 1: General circular framework (Konietzko et al, 2020)

Circular innovation can take place when coordinated with the life cycle stages of materials and energy. The life cycle stages usually include the phases of raw materials, production, consumption and waste management (Ogunmakinde, 2019). In practice, circularity has a high potential for realization in the life cycle stages of multiple industries (eg., energy sector, plastic industry, pulp and paper industry). To achieve circularity, it is necessary to involve multiple stakeholders and create appropriate collaboration and communication modes in all stages of the industrial life cycle (Ghisellini et al, 2016).

1.1.2 The threefold distinction of state, civil society and individual enterprise

The whole process of realizing circular innovation includes initiative, strategy and implementation. In order to complete this process, an appropriate environment is necessary to support the innovation implementation. To address the support environment for innovation, this research adopts a threefold distinction including three layers (i.e. the state, civil society, and individual enterprises) (Kroesen, 2020).

According to the research of Jackson et al. (2008), changes in each level and the interaction between the three levels can create a favourable environment for the implementation of innovation.

In a typical innovation support environment, the country has strong, fair and responsible regulations from the government. Civil society includes various forms of cooperation among multiple stakeholders. And individual enterprises are specific participants who actively implement innovation (Jackson et al, 2008).

In these three levels, two different modes can usually be identified to achieve innovation: bottom-up and top-down. Specifically, civil society and the state tend to enable the initiatives that are from individual companies. In turn, the state can initiate innovations on its own, and civil society stakeholders and individual companies can also implement these innovations. In addition, civil society stakeholders and individual companies can also take initiative themselves (Kroesen, 2020).

1.1.3 System I and System II

The book "Cross-Cultural Entrepreneurship and Social Transformation" by Otto Kroesen et al. (2020) identifies the two conceptual differences of the system. These two identified systems can be applied to the research of achieving innovation through three levels. They are named System I and System II respectively, and their rules and functioning are different in terms of the three levels.

According to Kroesen (2020), System I works when the state is characterized by institutional voids or unaccountable and in equitable institutions, and civil society is characterized by vertical networks of a patrimonial and clientelistic character, and the innovations from individual enterprises are difficult to penetrate through civil society and the state. In contrast, in System II, an open civil society and universalistic state allow both bottom-up initiatives and top-down interventions, and innovations in System II can be coordinated by multiple stakeholders in the STS. In both systems, the technological transition can take place in different manners.

Conceptually, the rules and functioning of System I can be implemented in many developing countries such as Indonesia. And System II is highly relevant to developed countries such as the European Union. But in reality, different characteristics of various countries and regions can be reflected in the continuum between System I and System II. It can be considered that this continuum is parallel to the social changes taking place on a global scale (Kroesen, 2020).

In developing countries, a transformation of socio-technical systems (STS) is generally taking place (Kroesen et al, 2020). The implementation of circularity needs a change of the current STS in Indonesia where the innovations of circularity interact with the multiple levels (state, civil society, individual enterprise) to realize circularity. Put otherwise, the interaction of actors, rules and technical systems between Landscape, Regimes, and Niches can enable the implementation of circularity. It is therefore interesting to apply the multiple dimensions of the state, civil society and individual enterprises to envisage, analyse and assess how circular innovation can occur in Indonesia.

In developing countries such as Indonesia (System I) and developed countries such as the Western countries (System II), two assumptions of circularity realization can be generated. One assumption is the circularity innovations taking place in System I. A strong state orchestrates all the cooperation and interaction of multiple levels from above, this way the innovations could be implemented. While another assumption is the realization of circularity in System II. Both bottom-up initiatives and top-down interventions work together to enable interaction and cooperation between multiple levels so that the innovations of circularity can be coordinated. In this way, this report aims to provide a vision and recommendations on how these two systems can achieve circularity in Indonesia and the West through the MLP. Furthermore, this research looks into the continuum between System I and System II to explore the transition between both systems.

1.1.4 Circularity/innovation implementation in European countries and Indonesia

Circularity (circular economy) is being developed in many countries around the world where it has been set as a development goal (Schröder et al, 2019). However, the progress in implementing circularity varies from country to country. Most of the countries that are leading in circularity are European countries (Construcia, 2020). The Global South is less advanced than the former, but the development of circularity is necessary and urgent for the Global South. For example, in Indonesia, where lagging industrial development and high levels of waste generation are currently causing problems such as industrial depression, environmental pollution and threats to human health, the implementation of circularity can help sustain and promote industrial development and address the problems caused by growing waste (Preston & Lehne, 2017). At the same time, in the face of the current global problem of increasing

resource consumption, the implementation of circularity has been identified as an important goal not only for regional development, but also as a common priority for global development (Circular Economy Action Plan, 2020). In this context, this study therefore aims to investigate how to accelerate the implementation of circularity in the Global South and European countries. Furthermore, innovation related to circularity is included in the theme of this study.

1.2 Research gap

The research gap section is described in a step-by-step manner, starting with a list of relevant studies that exist and then noting the characteristics of this study and how it differs from related studies. The first part is an introduction to relevant research on circularity/innovation implementation, which draws out the direction of this study by distinguishing between research directions that improve specific aspects of implementation and the factors behind implementation. The second part is about the themes included in this study, which cover several topics (circularity/innovation, institutional and social transformation, and entrepreneurship). A comparison is made between existing studies containing these themes and this study, thus highlighting the simultaneous inclusion of multiple themes in this study. The third part deals with comparative case studies. Some existing comparative case studies on circularity/innovation are first presented and the particular points in this study are highlighted. Furthermore, the Social Transformation Model (Kroesen et al, 2020) applied in this study is seen as a reflection of the gaps in this study and will be explained accordingly.

1.2.1 Specific aspects of circularity/innovation implementation and factors of circularity/innovation implementation

There have been a number of papers examining circularity/innovation at both factual and technical levels. Typical examples are studies from the perspective of industry chains (supply chains) and logistics, and in particular some of these papers explore how circularity/innovation can be achieved through specific aspects such as business models (Yang et al, 2018; Bocken et al, 2016), product design (Bocken et al, 2016; Den Hollander et al, 2017), and digital technologies (e.g. IoT, big data and AI) (Ghoreishi & Happonen, 2020). These studies all focus on achieving circularity/innovation by optimising the management of the specific components (eg., supply chain stages, business models, product design) that make up circularity/innovation in order to achieve a shift from the traditional linear economy chain to a circular economy chain. It can be seen that these studies have focused on improving specific parts of circularity/innovation to achieve circularity/innovation as a whole.

However, unlike the studies introduced above, the present study chose to examine the factors in the implementation of circularity/innovation. Specifically, while the above

studies examined how circularity/innovation can be achieved through optimising technology and management, the present study examines the factors in circularity/innovation that have been achieved or are being implemented. Research on factors in circularity/innovation already exists, for example on factors that promote and hinder circularity/innovation (De Jesus & Mendonça, 2018; Ranta et al, 2018), and the aim of these studies is usually to provide decision-makers (eg., in the development of policies, social organisations, corporate strategies) with a factual basis that they can refer to in order to help them make better decisions. The present study decided to take this line of research and explore the factors that enable circularity/innovation.

1.2.2 Joint research on topics between circularity/innovation, institutional and social transformation, and entrepreneurship

Some existing research can be found in combining institutional & social transformation and circularity/innovation, more typically examining the lessons, drivers and barriers to implementing circularity/innovation in institutional & social transformation in developing (Wu et al, 2021; Mishra et al, 2019) as well as developed countries (Ghisellini & Ulgiati, 2020; Kerdlap et al, 2019), with the interaction between institutional & social transformation and the implementation of circularity/innovation being the focus of research. Furthermore, studies on the combination of entrepreneurship and circularity/innovation can be found in a number of framework model studies on supporting entrepreneurship through circular innovation (Makropoulos et al., 2018; Cullen & De Angelis, 2021), which are also actual case studies.

Ultimately, this study decided to combine the three themes of circularity/innovation, entrepreneurship and institutional and social transformation, which were chosen partly because of the lack of research combining all three themes at the same time, thus giving this study a particular footing. From a practical point of view, this study aims to provide insights and strategies for stakeholders who are or will be involved in implementing circularity/innovation in the context of institutional and social transformation, in order to help them optimise their decision-making. On the other hand, the combination of the three themes fits relatively well with the structure and content of the Social Transformation Model (Kroesen et al, 2020) (2.3, Theoretical framework; 1.1.2 and 1.1.3, Introduction), which means that the Social Transformation Model is considered more suitable and has the potential to be applied to study these three themes. To date, only very few studies (Angginta, 2020) have been found to use the social transformation model to address circularity or innovation. Therefore, this study decided to use the Social Transformation Model to explore how circularity/innovation is implemented in relation to the themes of institutional and social transformation and entrepreneurship.

1.2.3 Regarding comparative case studies

It is well known that circularity/innovation research and development is relatively well established in Europe compared to other regions (Ranta et al, 2018). In recent years, the number of circularity/innovation studies in the Global South and developing regions has also increased (Márquez & Rutkowski, 2020; Gutberlet et al, 2017; Preston et al, 2019). More recently, comparative case studies on circularity/innovation in Europe and the global South, as well as in developing regions, have started to emerge (Ferronato et al, 2019). This series of research developments illustrates that circularity/innovation is evolving further towards the global level. This study has also chosen to conduct comparative case studies of different regions. So far, existing studies addressing circularity/innovation can be found in Indonesia (Adi & Wibowo, 2020; Fajar & Ardi, 2021; Pasaribu, 2016; Rishanty & Suryahadi, 2020) and regional studies in Europe respectively (Bocken et al, 2016; Den Hollander et al, 2017) were found. However, the number of comparative case studies of circularity/innovation between Europe and Indonesia is small (Kurniawan et al, 2020). Therefore, this study selects Europe and Indonesia as the two comparative regions for comparative case studies on circularity/innovation.

Comparing cases from multiple regions may produce results that are useful for multiple regions. One finding that emerged from the initial literature search was that Indonesia has a lower level of circularity/innovation than EU countries (EMF, 2020), so it is conceivable that this comparative case study would be very useful for the development of circularity/innovation in Indonesia by drawing on European experiences. At the same time, there is still room for improvement in circularity/innovation in EU countries, which may find some insights in the case study with Indonesia. Although the development of circularity/innovation in Indonesia is more lagging behind compared to some EU countries, it can be argued that the EU and Indonesia have different problems, stages and goals in implementing circularity/innovation and therefore it cannot be concluded which side is facing a more difficult situation. Furthermore, the implementation of circularity requires the involvement and cooperation of multiple stakeholders from different supply chain stages, which means that it takes place not in one region but in multiple regions, while the implementation in different regions can influence the implementation in other regions, as they are interlinked. Through these considerations, a hypothesis can be generated that the reference to the Indonesian case will help European countries to implement circularity/innovation.

The central question for comparative case studies of multiple regions is how to make comparisons. In this context, the Social Transformation Model (Kroesen et al, 2020), which incorporates System I and System II, can be used to study circularity/innovation implementation at the state, social and firm levels in Indonesia and European countries respectively (1.1.3, Introduction). Firstly, it can be observed that the System I and System II settings are based on a distinction between less developed and developed regions, so they can potentially be applied to study Indonesia and some European countries, respectively. We do not expect the functioning and rules of Indonesia and European countries to be identical to those of System I and System II,

but it is sufficient that their characteristics are close to those of System I and System II, or fall between the continuum of System I and System II. Furthermore, in line with the original purpose of the Social Transformation Model, which is to help entrepreneurs succeed in social transformation or between System I and System II (Kroesen et al, 2020), in this study we argue that the Social Transformation Model has the potential to facilitate relevant stakeholders involved in implementing circularity/innovation (e.g., firms, social organisations, policy makers) to move between System I and System II. As mentioned above (1.2.2, research gaps), the number of studies applying Social Transformation Model to address circularity/innovation is very low. Therefore, in this study, the comparative case study between European countries and Indonesia innovatively applies the Social Transformation Model (2.3, theoretical framework) in order to explore how circularity/innovation can be achieved in System I and System II or on a continuum between them.

1.3 Research aim

The goal of this study is threefold. Firstly, it aims to provide a case description of the implementation of circularity/innovation in the EU and Indonesia, and to analyse the progress of implementation therein. Second, the distinctive characteristics behind the implementation of circular innovation in the EU and Indonesia will be identified. Third, it is aimed at helping decision-makers in the EU and Indonesia make preferable decisions to achieve circularity/innovation.

1.4 Research question

As illustrated below, four research questions are identified. Each of these research questions will be answered in the following chapters.

1. ***For this research, what industrial and regional boundaries can be set, and what research methods can be established?***
2. ***How has circularity/innovation been implemented or is it being implemented in European countries and Indonesia?***
3. ***What distinctive characteristics can be identified behind the implementation of circularity/innovation in European countries and Indonesia?***
4. ***What case comparisons can be established between European countries and Indonesia?***
5. ***What recommendations can be drawn to facilitate the implementation of circularity/innovation in European countries and Indonesia?***

2.Research approach

This chapter aims to answer this research question:

For this research, what industrial and regional boundaries can be set, and what research methods can be established?

2.1 Case selection

To study a case in a cyclical/innovation implementation, the case must be specific with details so that the study can be conducted. Otherwise, the research will be too general, resulting in the description of circularity/innovation implementation not taking shape. First of all, case selection is important.

In this study, three cases were determined: biogas technology, plastics industry, and pulp and paper industry. Also, three European countries were selected to correspond to these three cases for a comparative study with Indonesia. In the case of biogas technology, the European country selected for this study is Finland. For the case of plastics industry, the European country selected for this study is Germany. The European country chosen for the case of the pulp and paper industry is Sweden. The reasons for the selection of these cases and countries are presented below.

2.1.1 Biogas technology

Biogas production as a mode of resource recycling (eg., from agricultural waste, household waste, etc.) is rapidly developing worldwide (Deremince & Königsberger, 2017). The refined biogas from waste is considered as an almost greenhouse-gas-neutral energy carrier (Lambert, 2017), whose application is environmentally friendly. In addition, the digestate generated from biogas production can be used as an excellent fertilizer (Valve et al, 2020).

Biogas technology has received high attention from the Indonesian government, and relevant policies and national projects have been initiated in Indonesia (Bößner et al, 2019; Taylor et al, 2019). In addition, a number of bottom-up initiatives organized by international stakeholders have emerged in Indonesia (Silaen et al, 2020). This illustrates that biogas technology has started to develop in Indonesia. However, the market for biogas technology in Indonesia is still nascent (Rianawati et al, 2021). Therefore, there is potential to explore how biogas technology can be implemented in Indonesia through the level of the state, civil society, and individual enterprises. In contrast, Finland, as one of the EU member states, has been developing its particular circular nutrient economy with a high rate of nutrient recovery under the trend of circularity (Valve et al, 2020), which is key to the circularity in biogas production process. In the last decade, a series of policies for biogas technology have been developed and implemented in Finland (Humalisto et al, 2020). At the bottom in Finland, biogas plants and biofuel supply chains have been implemented to some extent (Winquist et al, 2019). However, the occurrence of inefficient nutrient recycling and inconsistent standards for digestate use, among others, have still been pointed out in Finland (Valve et al, 2020; Huttunen et al, 2014). These facts have a negative

impact on the circularity implementation of biogas technology in Finland, so it is promising to study how biogas technology can achieve further circularity in Finland. In this way, this study decided to make a case comparison of the implementation of biogas technologies in Finland and Indonesia, thus promoting mutual circularity/innovative development.

2.1.2 Circularity of plastics

Plastic waste has negative impacts on the environment and there is a need to enhance the circularity of plastic waste (Sustainability, 2021). However, the current plastics supply chain has a number of characteristics that run counter to circularity (Wilts & Bakas, 2019). For example, most plastic products are designed and produced for single use, without consideration for reuse, and are primarily used for products with short lifetimes and high consumption, such as packaging. Moreover, plastic products often contain hazardous substances that pose challenges to the recycling process and reuse. There is also the fact that the current recycling rate of plastics is low, with downcycling dominating (Wilts & Bakas, 2019).

Indonesia generates about 6.8 million tons of plastic waste annually, but most of it is not properly disposed of due to its poor waste management system (World Economic Forum, 2021). Furthermore, Indonesia is the second largest generator of marine plastic waste in the world, which has detrimental effects on local tourism, environmental and marine life, and human health (Burhanuddin, 2018). To address these issues, the government has stated that Indonesia will reduce waste through the 3R principles (reduce, reuse, and recycle resources) by 2025, with the goal of reducing plastic waste by up to 70% by 2025 (Burhanuddin, 2018). It has been observed that there are already a number of initiatives and programmes to deal with the plastic waste problem in Indonesia (Bor, 2020; Stuchtey et al, 2019). Then how the implementation of circularity/innovation for the plastic waste problem would develop in Indonesia is the question explored in this study. In contrast, Germany is a pioneer country in incorporating recycling into its waste management system (Lee et al, 2021). Waste recovery and recycling rates in Germany have continued to rise over time, reaching 81% and 69%, respectively, in 2018 (Schroeder & Jeonghyun, 2019). Furthermore, Germany has achieved a successful decoupling between economic growth and waste generation (Schroeder & Jeonghyun, 2019). In 2017, Germany generated 32 kg of plastic waste per person per year, 28 kg of which was packaging waste (Schmidt & Laner, 2021). To address this issue, regulatory policies and implementation of circularity in the German packaging supply chain have been carried out (Schroeder & Jeonghyun, 2019). Therefore, Germany can serve as a powerful reference country for the development of circularity/innovation in plastic waste in Indonesia for comparative case studies, which can not only contribute to the development of circularity/innovation in Indonesia, but also provide new insights and strategies for the development of circularity/innovation in Germany.

2.1.3 Innovations in the pulp and paper industry

The pulp and paper industry produces products based on renewable resources and its products can replace many everyday products made from fossil materials such as plastics (Tillväxtanalys, 2014). At the same time, by-products of the pulp and paper industry, such as fibre sludge, have been proven to have a wide range of applications in

other industries, such as use as fossil-free bioplastics, biohydrogen fuel and fish feed (Pawar et al, 2020). Moreover, the pulp and paper industry is an energy and resource intensive industry in which innovations to enhance energy and resource efficiency and circularity have emerged.

The Swedish pulp and paper industry has the following advantages. Firstly, it has managed to reduce its negative environmental impact over the last 40 years while maintaining positive economic growth (Scordato et al, 2018). Secondly, Sweden plays an important role in the global pulp and paper market (Scordato et al., 2018). Sweden has approximately 1% of the world's commercial forest area, but provides about 10% of the global market for sawn wood, pulp and paper (Kumar et al, 2020). At the same time, Sweden is the second biggest exporter of pulp and paper products in the world (Kumar et al, 2020). As for pulp production, about a quarter of the total pulp consumption in the EU is produced in Sweden (Swedish Forestry Association, 2020). Third, Sweden is a forest-rich country that provides favorable resources for its pulp and paper industry (Bauer, 2018), which is also reflected in Indonesia, which has abundant forest resources (Greenpeace, 2020). In 2018, the Swedish pulp and paper industry accounted for 51% of the total industrial energy use, which is mainly from renewable energy sources (Johansson et al, 2021). This indicates that the Swedish pulp and paper industry has already achieved some degree of energy efficiency, and with the trend of implementing circularity in the EU, the Swedish pulp and paper industry has the potential to leapfrog into a fully or partially implemented circularity industry, making it worthwhile to choose to explore circularity/innovation research in Sweden. As regards Indonesia, from a preliminary literature review it appears that the development of circularity/innovation in the pulp and paper industry is still relatively limited. In this way, it is possible that Indonesia could gain some insights and strategies to draw on when compared to the case of the Swedish pulp and paper industry. Furthermore, some reports indicate that the pulp and paper industry in Indonesia poses problems such as deforestation and environmental pollution (Mongabay, 2020; Theguardian, 2016), and whether and how circularity/innovation in these issues has been implemented in the pulp and paper industry to improve the situation becomes a question explored in this study.

2.2 Research scope

2.2.1 Thematic scope

In this study, circularity is considered to be a form of innovation, and therefore implementing circularity is equivalent to implementing innovation. At the same time, a number of innovations related to circularity are also subsumed within the scope of this study. Circularity/innovation is therefore the central theme of this report.

The life cycle stage is the critical component to create circularity. This study will not focus on the technical aspects of the life cycle phase. Instead, the case description and

analysis in the implementation in the life cycle stage toward circularity/innovation is the main focus.

2.2.2 Geographic scope

The geographical scope of this study includes Indonesia and the European Union. The unit of study for this research is the country. Specifically, three examples from specific member states of the EU (i.e. Finland, Germany and Sweden) were selected for the study with Indonesia.

2.3 Theoretical framework

The Social Transformation Model (STM) developed by Kroesen et al. (2020) was developed to examine how firms achieve success in institutional and social transformation. It consists of the study of three levels: the state, civil society, and the individual enterprise. Each level of the STM has different institutions and values within it. In addition to the distinction between levels there is also a distinction between systems (System I and System II) (Kroesen et al, 2020). Thus, the institutions and values under the different systems unfold in three levels. The table below illustrates the institutions and values of System I and System II. It is also important to note that the *institutions* and *values* in STM are collectively referred to as *distinctive characteristics* in this study.

Table 1: Distinctive characteristics of System I and System II (Kroesen et al, 2020)

	System I		System II	
	Institutions	Values	Institutions	Values
State	Patrimonialism at the top, granting favors and privileges in return for services	Obedience and loyalty, hierarchy, status personalized relationships, particularism	Rule of law, equal access, strong but accountable state institutions, property protection, contract enforcement	Universalism, Equal access, justice, transparency
Civil society	Closed in groups, vertical networks, little cooperation	Lifelong solidarity, adaptation to the group, traditionalism, uncertainty avoidance	Civil society, open cooperation at the bottom, changing coalitions (apart from family loyalty and state authority)	Open attitude, mutual adaptation, multiple memberships, pluralism of opinions
Individual enterprises	Family based, distributed activities, dependent on position and opportunities in the vertical network	Command and control, status through position, closed in-group ethos, loyalty counts more than efficiency, synchronic time management, privileged treatment of in-group members	Open labor market, contracts, instrumental working relations, both of competition and cooperation between competitors	Individual judgement, professional attitude, initiative, status by achievement, planning and innovation, cooperative attitude, equal treatment, teambuilding

The theoretical framework for this study is extracted from the book 'Cross-cultural entrepreneurship and social transformation' by Kroesen (2020). The core elements that constitute the whole research model are state, civil society, and individual enterprises. The relevance behind the theoretical framework is to realize a social

transformation toward circularity in the global south through the changes taking place from the multidimensional perspective (the state, civil society and individual enterprises). The targets that are applied to the research model are the three cases of innovations toward circularity in the European countries and Indonesia. Three main goals throughout the research model are identified. Firstly, in the European and Indonesian cases, the implementation process of the circularity/innovation will be described from a multidimensional perspective. Secondly, the distinctive characteristics in the European countries and Indonesia to influence the implementation of circularity/innovation will be analyzed. Thirdly, the recommendations for Indonesia and the European countries to achieve circularity/innovation will be generated. The figure below illustrates the preliminary research model of this study.

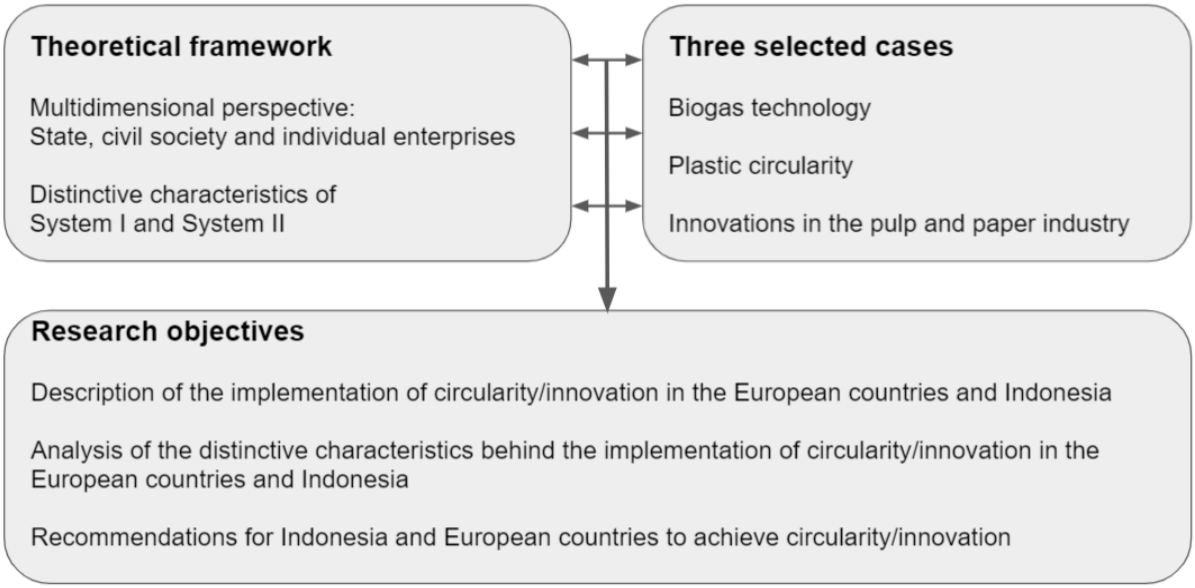


Figure 2: Preliminary research model

2.4 Research model

The core elements of this study include factual descriptions, implementation progress, distinctive characteristics behind the implementation, comparison between European countries and Indonesia, conclusions and recommendations for Indonesia and European countries. All elements linked together form the research model for this study. The diagram below shows a simplified principle of the relationship between the core elements of the research model. The relevance and role of these elements and relations will be presented below.

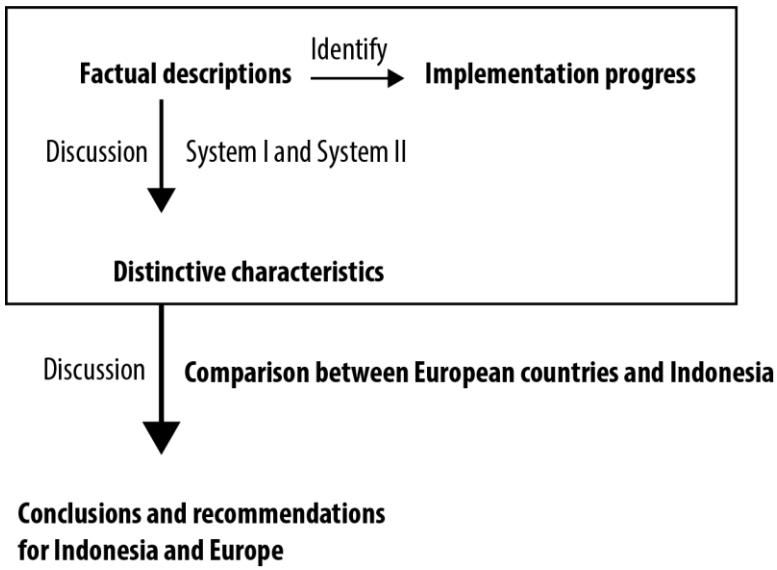


Figure 3: Core elements of the research model and the links between them

2.4.1 Factual description

The chapter factual description (case description) plays a fundamental role in this study. The literature search and review is conducted in this phase. This chapter provides the relevant data that will be further analyzed through the whole research.

The contents of fact description are organized through the three levels of state, civil society and individual enterprise. Three questions are formulated to address the fact description. The circularity/innovation in the three cases (biogas technology, plastic industry, pulp and paper industry) in European countries and Indonesia are studied.

a) What has taken place on the level of state toward circularity/innovation?
b) What has taken place on the level of civil society toward circularity/innovation?
c) What has taken place on the level of individual enterprise toward circularity/innovation?

To realize the implementations of innovations, all three levels need to be involved, in other words, the changes need to penetrate through the state, civil society, and individual enterprises in order to facilitate the implementing process toward circularity. It is thus necessary to describe the facts on each level and the interactions among these levels.

The working principle of changes through multiple levels can be categorized as two typologies: top-down and bottom-up. The top-down approach is starting from the state interventions in which relevant policies and regulations are issued. The stakeholders on the level of civil society and individual companies will adopt and follow the conducive policies by the state, in which different initiatives and strategies will be applied by multiple actors to implement the innovations. The bottom-up approach is contrary to the former. The actors from the levels of civil society and individual enterprises such as NGOs, government agencies, and start-ups start with their own initiatives and strategies to move on. The state then incorporates their

implementation into relevant legislation and policies. Meanwhile, in both top-down and bottom-up approaches, there is a great deal of discussion and negotiation through which initiatives can be adapted and changed.

Besides, in the process of changes taking place through the multiple levels, the involved actors and their relationships all play important roles. According to Fukuyama (2011), a state needs to be strong and equitable that abides by the rules of law. In this way, the relevant policies issued by the state are powerful and respectful. Meanwhile, it should be accountable which implies that the changes through the state, civil society, and individual companies are open and penetrable. Moreover, the relationships among stakeholders in the levels of civil society and individual enterprises are regarded as cooperation that needs to overcome the diverse conflicts and reinforce common efforts. The trust between multiple stakeholders is the key. Last but not least, the aspects of the business culture and customer behaviour are relevant, which is considered as the terminal phase in the implementations of innovations.

2.4.2 Implementation progress

The implementation progress section plays an important role in this study. The implementation progress of circularity/innovation can be evaluated in the factual description. The evaluated implementation progress will be used in the comparative analysis of Europe and Indonesia for further analytical content.

Implementation progress is evaluated on a factual basis, with the aim of distinguishing whether the implementation progress of circularity/innovation is positive, negative, ongoing, or for which no concrete data are available. The evaluation method is to identify identifiable descriptions from the facts. Identifiable descriptions can reveal positive, negative or uncertain information about circularity/innovation. In this way, the results of this identification can be derived: positive (P), negative (N), ongoing (O) and no concrete data (D). The following are examples of how the analysis can be conducted.

For example, the feed-in tariff for biogas plants has led to the participation of a number of biogas plants, which indicates that the implementation of biogas technology has been implemented to some extent and therefore the progress of implementation is positive. The different environmental standards for biogas digestate used in different sectors hindered the implementation of biogas technology between sectors, which indicates that the progress of circularity/innovation implementation is negative. In the implementation of circularity/innovation, relevant regulations and policies are issued by the government, but the underlying stakeholders are not told whether they are involved or not, and there is no concrete data on the outcome of this situation. An innovation model is being engaged in by a number of stakeholders, plans and strategies have been established, but results have not yet emerged, this situation is considered as ongoing.

2.4.3 Distinctive characteristic

Distinctive characteristics can be interpreted as having both positive and negative connotations. Positive distinctive characteristics promote circularity/innovation, while negative distinctive characteristics hinder circularity/innovation. For this study, the distinctive characteristics behind the facts can be derived by analysing the correspondence between the factual descriptions and the existing distinctive characteristics of System I and System II (Kroesen et al, 2020).

2.4.4 Comparison between European countries and Indonesia

In the comparison between the European countries and Indonesia, three indicators were taken into account for the comparative analysis. The first indicator is the outcome of the implementation progress (positive, negative, ongoing, no concrete data). The second indicator is the distinctive characteristics behind the factual descriptions. The third indicator is the factual description. Conclusions and recommendations for Indonesia and European countries will be drawn from the comparison between the European countries studied and Indonesia.

2.4.5 Conclusions and recommendations for Indonesia and European countries

This element is the final outcome of this study. It is mainly derived from the comparative analysis of cases from European countries and Indonesia.

2.5 Research outline

This study consists of five chapters. The first chapter is an introduction. Chapter 2 is about the research methodology. Chapter 3 is the case description. Chapter 4 is the integrated discussion. Chapter 5 is the final conclusions and recommendations. In addition, a section on limitations, research implications and recommendations for further research are placed in Chapter 5, and an overview of the detailed comparative analysis of European countries and Indonesia is included in Appendix 1.

The case description in Chapter 3 is the same matter as the description of the facts in the research model section, and the presentation of the conclusions and recommendations is also included in the research model. Having said that, it is necessary to briefly explain the difference between the research model section of this study and the research outline section. The research model is the tool used to execute this study and therefore its content contains the main elements of this study. The research outline, on the other hand, is an objective presentation of the content (chapters) of this study. There will be some overlap between them, but there is a fundamental difference.

The role of the discussion chapter is to provide an analysis based on both positive and negative aspects of the case descriptions. The positives and negatives are mainly related to the identified progress in implementation and different interpretations and opinions are drawn from the positive, negative, ongoing and results for which no specific data are available. The results of the discussion will form the conclusions and recommendations.

The diagram below integrates the chapter information (marked in red) with the core elements of the research model and the links between them.

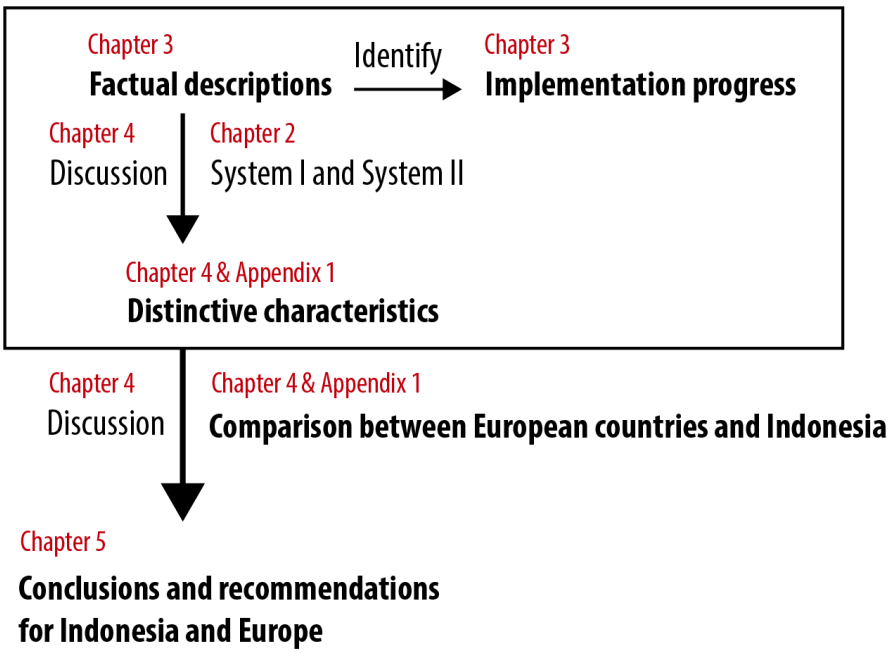


Figure 4: The core elements of the research model and the links between them (with the chapter information marked in red).

3. Case description

The aim of this chapter is to conduct the factual descriptions of European countries and Indonesia in the implementation of circularity/innovation. Three cases from European countries and Indonesia are described through a multidimensional perspective (state, civil society and individual enterprises). The description ends with a case analysis in a comparison between the European country and Indonesia. In the comparisons, the factual descriptions are consistent with the distinctive characteristics reflected from the facts. The general details of the analysis can be found in Appendix 1.

This chapter aims to answer the following research question:

How has circularity/innovation been implemented or is it being implemented in European countries and Indonesia?

3.1 Biogas technology

3.1.1 Finland

The Finnish government has a clear position on biogas technology, including the route and the objectives of its implementation. According to Winquist et al. (2019), the policies introduced by the Finnish government that are favourable to the implementation of biogas technology in Finland are mainly aimed at the establishment of biogas plants and the energy generated by biogas technology. With this clear orientation, relevant biogas technology policies have been published and implemented in Finland with relative success.

Three types of these policies can be further identified: 1) feed-in tariffs and feed-in premiums; 2) investment subsidies; and 3) biogas-related fuel policies (Winquist et al, 2019). Meanwhile, three national actors are involved in the regulatory framework for biogas technology in Finland. Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry, and Ministry of Transport and Communications (Winquist et al, 2019).

3.1.1.1 State

1. ***Support policy for electricity production from biogas plants***

Finland has a system of feed-in tariffs and premiums mainly for electricity production from biogas plants. The feed-in tariff is paid by the Energy Authority of Finland and applies to new biogas plants with a specified number of nominal generating capacities (Energy Authority, 2018). For example, the minimum tariff price for electricity produced from biogas is set at €83.50/MWh, with an additional premium of €50/MWh paid if the heat generated is also utilised, provided that the total efficiency of the energy utilisation is at least 50% (Energy Agency, 2018). In addition, new biogas plants in Finland receive a tariff for a maximum of 12 years.In 2018, four biogas plants in Finland received a feed-in tariff (Energy Agency, 2018). After 2018, for biogas technologies implemented in Finland, the feed-in tariff is replaced by a premium

system, where an additional heat premium is paid if the heat generated is also utilised by the biogas plant and the relevant requirements for total efficiency are met (Energy Agency, 2018). However, no biogas projects have yet been accepted as feed-in tariffs (TEM and the Energy Authority, 2019). These policies all illustrate the interpretability of policies aimed at steering stakeholders into environmentally friendly routes.

Identifiable description	Implementation progress
Four biogas plants in Finland received feed-in tariffs in 2018.	Positive

2. High adjustability of policies based on practical performance

The Finnish government has introduced flexible policies to meet the practical effects of biogas technology implementation. The results of implementation are always observed and appropriate adjustments are made based on the actual performance of the relevant policies. For example, the Finnish government has adjusted the characteristics of its policy from a feed-in tariff to a premium system in response to the actual situation. As the performance of the feed-in tariff, which was set at a fixed price, did not perform as expected (i.e. only four biogas plants received a feed-in tariff), a premium tariff system was introduced (Winquist et al, 2019). The new premium system provides that renewable energy plants offering electricity at the lowest premium will meet the requirements of the policy through an auction (Winquist et al, 2019). This new change compared to the previous policy demonstrates the alignment of state intervention between the intended objectives and the actual implementation of biogas technologies.

Identifiable description	Implementation progress
This factual description demonstrates the accountable nature of policy making and the progressive nature of policy implementation in Finland.	Ongoing

3. Adequate and reasonable investment subsidies for biogas plants

An investment subsidy is an option for biogas plants in Finland, in addition to the feed-in tariff or premium system. It is paid by the Ministry of Employment and the Economy and covers a stable and attractive amount of acceptable investment costs (Winquist et al, 2019). Investment subsidies for biogas plants are considered necessary, especially when the investment costs are large. Both industrial and agricultural biogas plants are eligible for investment subsidies, which facilitates their participation in Finland (Winquist et al, 2019).

Large industrial biogas plants consider investment subsidies more stable and necessary than feed-in tariffs, even if the latter have shown higher profitability over the years.

For agricultural biogas plants, the Ministry of Agriculture and Forestry's EU Rural Development Programme 2014-2020 has played an important role in the implementation of biogas technology in Finland (Winquist et al, 2019). At the same time, farm-scale plants have specific requirements for subsidies depending on the

situation. Different subsidy amounts are paid depending on whether the generated energy is sold externally, where farm-scale plants that use the generated energy themselves will receive a higher subsidy amount than if it is sold externally (Finnish Food Authority, 2019).

In addition, farm-scale plants have increased new opportunities to sell energy, such as selling biofuels for transport, which is also highlighted by the relevant policy, where new individual companies are allowed to be established with relative subsidy support (Finnish Food Authority, 2019).

Identifiable description	Implementation progress
Both industrial and agricultural biogas plants are eligible for investment subsidies, which help their participation in Finland.	Positive

4. ***Technology policy: applying new innovations in combination with existing technologies in the transport sector***

The Finnish government has issued policies in favour of biogas technology, which provide for implementation in several sectors. Some policies not only consider the routes and objectives for implementing biogas technology, but also address its potential applications. Most interestingly, the application of biogas technology is considered together with existing technologies. For example, in the transport sector, the use of biomethane has facilitated the coverage of fuel infrastructure networks, including the existing limited natural gas network (Winquist et al, 2019). In addition, Finland has adopted a biofuel distribution obligation (Huttunen et al, 2014) that requires biofuels to be blended with fossil oil. Both examples illustrate considerations between existing fuel technologies and biofuel applications with the aim of accelerating biofuel implementation by optimising the relationship between biofuels and existing fuels.

Identifiable description	Implementation progress
The use of biomethane facilitates the coverage of the fuel infrastructure network, including the existing limited natural gas network	Positive

3.1.1.2 Civil society

Multiple stakeholders from civil society and individual businesses are involved in the implementation of biogas technology in Finland. For example, waste management companies are involved in investment decisions for biogas plants for organic waste treatment. And an energy service company and two fuel transport companies were involved in the construction of biogas plants until 2014 (Huttunen et al, 2014). Furthermore, next to the existing actors in the waste and energy sector, new companies were established to deal with biogas production, for example in the fields of environmental consultancy and agriculture (Huttunen et al, 2014). In addition, an investment company is dedicated to biogas financing, providing financial support to an enterprise to build a biogas plant (Huttunen et al, 2014).

1. ***Communication between civil society actors and policy makers and multiple sectors with the aim of biogas technology implementation***

Actors from civil society, such as grassroots actors, have had a clear impact on the implementation of biogas technology in Finland. They help policy makers to understand the practicalities of biogas production, which can be difficult for policy makers to address (Huttunen et al, 2014). At the same time, civil society actors have the potential to address policies from multiple fields in order to solve problems. For example, the Finnish forestry agency works to connect different sectors and contribute to the implementation of bioenergy projects by supporting negotiations between fragmented policies (e.g. rural, forestry and energy) (Leskinen, 2006).

Identifiable description	**Implementation progress**
Finland's forestry agencies link different sectors by supporting negotiations between fragmented policies (e.g. rural, forestry and energy) and contribute to the implementation of bioenergy projects.	Positive

2. ***Biofuel supply chains expanded due to the use of biofuel vehicles and the construction of farm-scale refuelling plants***

New supply chains for biofuels have been expanded in terms of the use of biofuel vehicles and the construction of farm-scale biogas plants (Winquist et al, 2019). The focus on consumer behaviour in the acceptance and use of biofuel vehicles has a great potential to increase the biofuel market in Finland. At the same time, the promotion of affordable and reliable biogas purification and distribution equipment contributes to the construction of farm-scale biogas plants. The transition from customer to producer is typically depicted in this decision of farmers. The development of an extended biofuel supply chain with open cooperation is promising in Finland.

Identifiable description	**Implementation progress**
The new biofuel supply chain has been	Positive

extended in the use of biofuel vehicles and the construction of farm-scale biogas plants	

3. Cooperative biogas plants: open cooperation between multiple farms

In the face of technical and financial challenges, farmers still find it difficult to accept digestate or other recycled manure, despite the relevant regulations (Huttunen et al, 2014). However, one important factor breaks this problem. This is the co-benefit that farm-scale biogas plants derive from electricity production, reducing the need to purchase electricity and heat. In addition, the digestate from biogas plants can be used as an excellent fertiliser to nourish plants, generating additional economic benefits (Winquist et al, 2019). Therefore, digestate from biogas digesters is accepted by many farmers.

The recycling of nutrients (biogas digestate) has greatly facilitated cooperation between Finnish farms, thus creating a biogas cycle. As industrial symbiosis of nutrients can take place between several farms in the same area, this has also stimulated more and more farmers to get involved, as the threshold for transporting biomass is lowered in cooperation. In this way, many cooperative biogas plants have been set up, in which different farms are seen as relevant stakeholders: farms involved in animal production (providing manure), farms involved in crop production (providing crop residues), organic farming (receiving organic fertilisers), and greenhouses (consuming excess heat). The common goal of cooperative biogas plants is to distribute the methane back to the farms in an appropriate proportion to meet their needs (Winquist et al, 2019). In this way, organic farming is implemented through biogas digestate as fertilizer. In addition, other important trends appear in the increase in farm size and the growing popularity of organic farming and sustainable food production (Winquist et al, 2019).

Identifiable description	**Implementation progress**
The recycling of nutrients (biogas digestate) has greatly facilitated cooperation between Finnish farms, thus creating a cycle of biogas.	Positive

4. Inconsistencies in application between multiple sectors hinder the implementation of innovations

The implementation of biogas technologies needs to be based on multiple sectors, where there are differences between multiple stakeholders. Different requirements from multiple sectors form a barrier to the basic implementation of biogas technology.

Different requirements for environmental permits in different regions and sectors hinder the implementation of biogas technology. For example, in the waste management sector, the Waste Act fosters different interests in biogas technology among individual enterprises and municipalities, which triggers them to work in different directions and creates inconsistent linkages at various stages of the biogas production supply chain (Huttunen et al, 2014).

Even when policies related to fertilisers are favourable for biogas production,

biogas developers and market participants find these regulations restrictive and not easy to adopt. This is due to a lack of consistency in measures related to agri-environmental payments and the Nitrate Regulation, which covers fertiliser use. For example, agri-environmental payments used to accept manure as fertiliser, but not biogas digestate, which hinders the implementation of biogas technology. Also, the forestry sector rejects the use of digestate as fertiliser, but it is acceptable in food production (Huttunen et al, 2014).

Identifiable description	Implementation progress
Different requirements for environmental permits in different regions and sectors hinder the implementation of biogas technology	Negative

5. ***Unbalanced forms of implementation between dominant and non-dominant sectors; negotiations formed between stakeholders in non-dominant sectors***

In the other energy production and use sectors, the relevant incentives are mainly for industrial-scale biogas plants. Policies are relatively absent for small and medium-sized distributed generation through biogas technology and other energy applications (e.g. injection into the natural gas grid for direct industrial production of biogas) (Huttunen et al, 2014). This usually occurs when the objectives and routes of the state, civil society and individual enterprises have been set, so that a skewed distribution of attention and available resources occurs between the main sectors and others. For example, some small and medium-sized distributed stakeholders complain that feed-in tariffs do not suit them and that some other energy applications miss out on relevant policies (Huttunen et al, 2014). This does have a negative impact on the implementation of biogas technologies in non-mainstream sectors.

Nevertheless, the following situation occurs mainly in the energy production and use sector. As the relevant incentives are mainly designed for industrial-scale actors, there is a relative lack of relevant policies for small and medium-sized distributed generation through biogas technology. Interestingly, however, because relatively little electricity is produced through biogas technology in this sector, many producers are forced to negotiate prices and grid access conditions with grid operators (Huttunen et al, 2014). This has provided an acceptable price for multiple stakeholders, resulting in new cooperation in the distribution of electricity from biogas plants.

Identifiable description	Implementation progress
This provides an acceptable price for multiple stakeholders, resulting in new cooperation in the distribution of electricity from biogas plants.	Positive

3.1.1.3 Individual enterprise

1. ***High level of proactivity of individual enterprises towards government policy***

Individual enterprises in Finland are highly sensitive to policies related to biogas technology and take action as soon as they are ready. In Finland, there are many initiatives by individual enterprises to treat organic waste through biogas technology. For example, the EU waste hierarchy has motivated Finnish individual enterprises to make investment decisions in biogas technology based on favourable policies, and they have also acted positively on policies related to renewable energy system technologies (e.g. wind and solar panels) (Huttunen et al, 2014). In addition, most residential buildings are required to separate their biological waste at source, as landfilling of organic waste was banned by 2016, which triggered a large number of initiatives by individual Finnish enterprises to treat organic waste through biogas technology (Huttunen et al, 2014).

Identifiable description	**Implementation progress**
The landfill ban has triggered a large number of initiatives by individual Finnish companies to treat organic waste through biogas technology.	Positive

2. ***Large companies build biofuel infrastructure and demand, stimulating new stakeholder engagement***

Although many biogas producers would like to produce transport fuels, the lack of favourable policies and high costs create barriers to their implementation (Huttunen et al, 2014). However, a new twist has emerged.

The Finnish state-owned company Gasum Ltd entered the biogas market in 2016 and acquired two companies with seven biogas plants, thus making it the largest biogas producer in Finland. In addition, Gasum Ltd set out to build new refuelling stations and sell purified biogas and biomethane as transport fuel (Winquist et al, 2019). It effectively breaks the local biofuel supply and demand deficit and addresses the limited investment in biofuels and their infrastructure (Winquist et al, 2019). As a result, the demand for biofuels for transport has increased significantly and has had relative impacts, such as increased demand for biofuel vehicles and refuelling stations (Winquist et al, 2019). At the same time, medium-sized and small companies are involved in the biogas market to follow the established infrastructure, which has led to the formation of an extensive biofuel supply chain (Winquist et al, 2019).

Identifiable description	**Implementation progress**
The demand for biofuels for transport has increased considerably and has had relative impacts, such as increased demand for biofuel vehicles and refuelling stations.	Positive

3. ***Establishing biogas refuelling stations on farms***

Between farm-scale plants and biogas as a transport fuel, co-benefits arise by lowering the threshold for farms to own their own filling stations. This is also thanks to the involvement of the large company Gasum Ltd, mentioned earlier, whose

infrastructure development of the gas refuelling network stimulated the owners of farm-scale plants to want more biogas as a transport fuel (Winquist et al, 2019). In addition, the first on-farm refuelling station was established by Metener Ltd and was subsequently joined by a number of individual businesses. For example, in two cases, local energy companies were involved as co-owners in farm-scale biogas plants. biohauki Ltd. and Palopuron Biokaasu Ltd. (Winquist et al, 2019). This also facilitates the resolution of problems in terms of investment capital.

Identifiable description	Implementation progress
The first on-farm petrol station was set up by Metener Ltd, which was later joined by a number of individual businesses.	Positive

4. ***Inconsistencies between the state and individual enterprises in the implementation of innovations***

Inconsistencies between the state and individual enterprises can occur in the implementation of biogas technologies in Finland. For example, the initiatives of individual enterprises to implement biogas technology differ from the preferential scheme for sustainable technologies (i.e. composting) accepted by environmental management (Huttunen et al, 2014), which undoubtedly increases the uncertainty of individual enterprises to invest in biogas technology. Furthermore, the Environmental Impact Assessment (EIA) process, the availability of local biomass and the decisions of funding organisations sometimes tend to delay the implementation of biogas (Huttunen et al, 2014). This can have a negative impact on the initiatives and plans of individual companies.

Identifiable description	Implementation progress
Preferential solutions accepted by environmental authorities (i.e. composting) increase the uncertainty of individual companies investing in biogas technology.	Negative

3.1.2 Indonesia

3.1.2.1 State

At the level of state intervention, the implementation of biogas technology in Indonesia lies mainly in the initiatives of state interventions and the involvement of civil society actors in state interventions. The government has launched several objectives and initiatives for the implementation of biogas technology (Bößner et al, 2019; Taylor et al, 2019). According to Taylor et al. (2019), the Indonesian government has designed two routes to implement biogas technology: small-scale household biogas for cooking and large-scale biogas for electricity generation. To achieve implementation, relevant stakeholders are involved in relative projects of state

intervention (Bößner et al, 2019). In addition, Indonesian farmers' perceptions on the use of biogas technology will be included. The case description of the state is sublimated in these themes.

1. ***National projects initiated by the government in the agriculture and forestry sector (small-scale biogas)***

Under the route of small-scale domestic biogas, the three projects currently implemented (i.e. SIMANTRI, Public Works, West Bali National Park) were introduced mainly by national interventions in Indonesia (Bößner et al, 2019; Taylor et al, 2019).

SIMANTRI was the first national project initiated by the Bali Provincial Government under the 'Green and Clean Bali' programme, started in 2009, in which biogas was used to treat manure needed for agriculture rather than for cooking needs.

Public Works is the second national project, funded by the Ministry of Energy and Mineral Resources (MEMR), which started in 2015.

West Bali National Park is the third national project, funded by the Ministry of Environment and Forestry, started in 2013 and focuses on the use of biogas by farmers to deal with illegal deforestation and land emissions.

Identifiable description	**Implementation progress**
The national projects have been launched and are being implemented.	Ongoing

2. ***Launch of biogas plant targets and policies***

With regard to the route to large-scale biogas generation, the Indonesian government has introduced ambitious targets and related policies. One objective, for example, is to address the issue of electricity coverage in unelectrified areas (Susanto, 2016). New regulations have been introduced to provide individual businesses with the opportunity to generate and sell electricity in areas that are currently unelectrified (Susanto, 2016). In addition, the government has strengthened feed-in tariff legislation to attract more individual businesses and other institutions to participate (Taylor et al, 2019).

Identifiable description	**Implementation progress**
The policies for biogas plants have been issued and the relative implementation at the bottom is being processed.	Ongoing

3. ***Inconsistencies in policies related to the energy sector***

Some policies in the energy sector (e.g., the expansion of coal mining in Indonesia) run counter to the goals of renewable energy (Taylor et al, 2019). This issue undoubtedly creates a barrier to the engagement of biogas stakeholders who may be concerned about the future of renewable energy technologies in general in Indonesia, let alone the biogas sector. This surprising finding reveals many issues in the implementation of renewable energy technologies in Indonesia.

Identifiable description	Implementation progress
Some policies in the energy sector (e.g. the expansion of coal mining in Indonesia) run counter to the goals of renewable energy, and this has certainly created barriers to the participation of biogas stakeholders.	Negative

4. ***Regulatory uncertainty between the public and private sectors***

As mentioned above, governments provide support for national projects in the public sector. Although private sector actors are keen to invest in biogas technology, it is uncertain to what extent state intervention will support private sector implementation. This increases the risk for private sector stakeholders and reduces their initiatives and plans for biogas technology. This regulatory uncertainty between the public and private sectors hinders business activities and may further reduce the willingness to collaborate between the public and private sectors (Taylor et al, 2019).

Identifiable description	Implementation progress
This regulatory uncertainty between the public and private sectors hinders business activity	Negative

5. ***Effective communication with stakeholders (e.g. farmers) through extension agencies (e.g. farmer groups, forestry agencies) with the support of the Indonesian government***

The role of farmers is crucial in the implementation of biogas technology in Indonesia. In the dissemination phase, extension agents supported by the Indonesian government play an important role in spreading information about biogas technology (Kadir et al, 2002). a study by Putra et al. (2019) showed that half of the farmers learned about biogas technology mainly through extension agents and many farmers had positive attitudes towards biogas technology (Putra et al, 2019). It shows that the Indonesian government has been effective through an extension system that works with multiple actors (e.g. farmers' groups, forestry agencies) (Kadir et al, 2002). At the same time, farmer groups, neighbouring farmers and NGOs have promoted the diffusion of biogas technology. However, the role of research institutions in the diffusion of biogas technology has been diminished (Putra et al, 2019).

Identifiable description	Implementation progress
Half of the farmers learned about biogas technology mainly through extension workers and many of them have a positive attitude towards it.	Positive

3.1.2.2 Civil society

Some of the results of implementation by international stakeholders have already taken shape (BIRU, 2020). For example, the Dutch Embassy and two international NGOs (i.e. HIVOS and SNV) started a 'BIRU' programme for biogas technology in Indonesia, and then HIVOS created Yayasan Rumah Energi (YRE) to succeed the BIRU implementation. The number of beneficiaries using biogas technology is now close to 120,000, from 12 provinces in Indonesia (BIRU, 2020). In addition, the participation of individual enterprises in biogas digester technology has increased due to the effective promotion of BIRU (SNV, 2015).

The main aim of BIRU is to provide opportunities for potential users while contributing to their economic well-being (BIRU, 2020). For example, users of biogas technology are able to generate potential income from the bio-slurry by using it as fertiliser.

1. ***Emerging initiatives and implementation from multiple international actors***

Existing initiatives from civil society come mainly from international actors such as Dutch NGOs, Danish embassies and actors from the United Nations Development Programme (BIRU, 2020; Environment Indonesia, 2018; UNDP, 2016). International stakeholders have organised several initiatives for the implementation of biogas technology in Indonesia. For example, the Dutch NGO Hivos organised and funded TRE-Indonesia to implement a biogas project, and later Hivos and TRE recruited local construction partners to install and maintain biogas digesters for farmers (Budiman & Zhang, 2018). In this manar, more and more domestic stakeholders in Indonesia are getting involved.

Identifiable description	**Implementation progress**
The Dutch NGO Hivos organised and funded the implementation of a biogas project by TRE in Indonesia, and later Hivos and TRE recruited local construction partners to install and maintain the digesters for the farmers.	Positive

2. ***The market approach triggers multi-stakeholder participation in the implementation of the innovation***

Unlike government subsidised projects that provide farmers with biogas installations free of charge, the market approach has been applied to charge them a certain amount of money for installation. The market approach triggered the involvement of multiple stakeholders (e.g., government agencies, construction organisations, cooperative and individual enterprises, other services) in the widespread dissemination of biogas technology implementation and the accumulation of additional funds (Budiman & Zhang, 2018).

Two international NGOs (i.e., HIVOS and SNV) worked closely with the Indonesian Ministry of Energy and Mineral Resources to implement a biogas project (i.e., BIRU), which received support and approval from the national government, and additional stakeholders were assured to participate with potential interest. Subsequently, HIVOS created Yayasan Rumah Energi (YRE), an independent entity to operate and develop the BIRU, which includes market-based carbon credits to reduce emissions without state intervention. In addition, the Norwegian Embassy and relevant partners (e.g. participants in the Energy Development (EnDev) programme) are involved in the implementation process (SNV, 2015).

Identifiable description	**Implementation progress**
The market approach has triggered the involvement of multiple stakeholders (e.g. government agencies, construction organisations, cooperative and individual enterprises, other service providers) in the widespread dissemination of biogas technology and the accumulation of additional funds.	Positive

3. ***Training and education for individual enterprises to facilitate the spread of innovation***

Communication with training and education is necessary during the implementation of a biogas digester project. The main content of training and education is about the value, application and instructions for the use (installation) of the bio-digester. This can be done between international NGOs and emerging initiatives within Indonesia. As the concept of biogas digesters is new to Indonesian users, a phase of spreading the innovation is essential in order to get them to accept it. As a result, a large number of local businesses have localised the bio-digester technology with training from SNV and the growth trend continues (SNV, 2015). Since 2017, work related to the dissemination of information and green knowledge on sustainable agriculture to individual enterprises has contributed to the implementation of BIRU (BIRU, 2020).

Identifiable description	**Implementation progress**
A large number of local companies have already localised their biodigester	Positive

technology with training from SNV, and the growth trend continues.	

4. Effective dissemination of innovation and customer acceptance

By 2015, BIRU had installed over 15,000 biodigesters, most of them with effective performance to generate a carbon economy (SNV, 2015). The number of beneficiaries in 12 provinces in Indonesia is now close to 120,000 (BIRU, 2020).

The direct benefits of biogas technology to users have been very effective in its implementation in Indonesia. The functions of biogas digesters are manifold: 1) cost savings compared to LPG, 2) reduction of livestock manure odour, 3) bio-slurry: excellent performance as a fertiliser with additional benefits, 4) reduction/removal of organic waste, and 5) use for cooking. These benefits have facilitated the involvement of new users and individual businesses, initially from the grassroots, and have accelerated their proliferation in Indonesia. This is also a typical application of Yayasan Rumah Energi's (YRE) marketing approach to implementing biogas technology. A number of civil society actors have made effective efforts in the implementation of biogas technology. Here are three case descriptions of new user involvement.

A variety of reasons have stimulated the use of biogas digesters in Wahyu Kundari. One reason is the high cost of liquefied petroleum gas (LPG). Compared to LPG, using a biogas digester can effectively reduce costs. But the main reason that triggered her to use a biogas digester was the smell of cow dung that disturbed her neighbours.In 2018, Mr Sarno (i.e. the head of the farmers' group) introduced the digester to Wahyu and Mr Sarno shared with her the benefits of a biogas digester, such as the reduction of cow dung waste and the production of gas that can be used for cooking. He also explained a lot about the types of food that can be cooked with biogas. In addition, the financial support from the Ministry of Environment in North Luwu District (Indonesia) for the bio-digester has been a great convenience for her family. The only costs were to pay for the workers' meals and drinks and to dig the holes. In addition, Wahye found that the bio-mud was very beneficial to the growth of her cocoa plants.Wahyu also educated her neighbours about the benefits of using a bio-digester.

In Lombok, Indonesia, two problems led Angga to choose BioMiru (mini home biogas): the staggering amount of organic waste from corporate kitchens and the high cost of LPG. bioMiru helped her solve these problems by converting kitchen waste into biogas for cooking and reducing the cost of LPG. angga's business is growing crops, vegetables and Angga uses the bio-slurry as a fertiliser for horticultural crops and vegetables, and also for sales. angga runs her business through a bio-digester.

Mr Slamet has the same motivation as Mr Wahyu Kundari, which led him to use a biogas digester. Mr Slamet first learned about biogas from the Sion Foundation, one of the building partner organisations of the Indonesian Domestic Biogas Programme (IDBP). The Sion Foundation helped him to set up a biogas digester. He also benefited by selling plants and using the bio-slurry as fertiliser.

Identifiable description	**Implementation progress**
The number of beneficiaries has reached almost 120,000, coming from 12	Positive

provinces in Indonesia.	

3.1.2.3 Individual enterprise

1. ***Interdisciplinary partnerships for innovative implementation***

The BIRU partnership has played a central role in the implementation of biogas technology in Indonesia. The main actors in the partnership are divided into two groups: implementation (construction and maintenance by a construction partner organisation called CPO) and financing from a hybrid financing module called HEF (BIRU, 2020).The BIRU partnership promotes market development and user penetration of biogas technology in Indonesia (BIRU, 2020).

Specifically, Yayasan Rumah Energi (YRE), created by HIVOS, has established a group of partners, specifically including domestic biogas digester experts, potential mapping users, CPOs (construction partner organisations), financial support to facilitate credit, and a team to monitor biogas quality (BIRU, 2020). In this way, a multi-stakeholder platform has been formed to implement BIRU in Indonesia.

Regarding the building partners of BIRU who play a central role in the implementation process, they work in an interdisciplinary manner in multiple fields. Some of the partner stakeholders are responsible for setting up biogas reactors and some for monitoring and controlling the quality of the reactors (BIRU, 2020). In addition, some partners work on training activities and procurement schemes for biogas technology (BIRU, 2020). Furthermore, some stakeholders (e.g. regional cooperation units, foundations or NGOs) in cooperation aim not only to increase the biogas market but also to create employment opportunities for communities by building biogas reactors in several regions of Indonesia.

Identifiable description	**Implementation progress**
BIRU partnership promotes market development and user penetration of biogas technology in Indonesia	Positive

2. ***Difficulties for customers (e.g. farmers) in installing, using and maintaining biogas facilities***

Despite the positive perceptions of farmers and the great progress made in the promotion of biogas digesters, customers have difficulties in installing, using and maintaining them. A number of factors can explain this. The complexity of installing, using and maintaining biogas technology is high for them and their lack of opportunity to try it out are potential problems (Putra et al, 2019). In addition, in the SIMANTRI project, there were problems with the management of the biogas installations, which hindered the dissemination phase of biogas technology in Indonesia (Devisscher et al, 2017).

Identifiable description	**Implementation progress**
The high complexity of installation, use and maintenance of biogas technology	Negative

by customers and the lack of opportunities to try it out are potential problems that hinder the implementation of biogas technology.	

3.2 Circularity of plastics

3.2.1 Germany

3.2.1.1 State

Since the 1970s, German waste laws and regulations have been gradually and comprehensively developed. The first focus was on waste treatment (i.e. the Waste Disposal Act), with an emphasis on safe waste disposal, including safer landfills and cleaner incineration. The second step was waste management (i.e. the Waste Act) to address the multiple treatments of waste, where recycling was made obligatory in 1986 (Schroeder & Jeonghyun, 2019). Since the 1990s, the circular economy has eventually driven Germany's focus on material recyclability (i.e. the Circular Economy Act). This gradual development can be described as a tentative experiment in optimal waste treatment in Germany. Furthermore, the gradual nature of the policy development has led to stability and effectiveness in the scope of implementation.

The Circular Economy Act and the Packaging Act are the two cores of German waste management regulations (Schroeder & Jeonghyun, 2019). The Circular Economy Act clarifies the basic concepts of the circular economy to support and stimulate law-making in plastics. The Packaging Act emphasises practical aspects, including key strategies for Extended Producer Responsibility (EPR) in the life cycle of plastics, and in this way generates a number of enabling policies. Based on these two cores, German plastics laws and regulations have been developed steadily and effectively (Schroeder & Jeonghyun, 2019).

1. ***Efficient development of legislation through multi-stakeholder participation***

In Germany, the generation and development of plastics legislation is very efficient. For example, a draft law for an EU regulation on plastic waste management was launched in November 2020 and was successively adopted for review in January 2021 (Kumar, 2021). The amendments are currently being revised and the new law will be implemented soon. In order to facilitate this rapid process of generating legislation, several authorities (e.g. the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, the Federal Cabinet, the Federal Parliament, the House of Lords) are effectively involved (Kumar, 2021).

Identifiable description	**Implementation progress**
The high efficiency of the German policy making process with the support of	Positive

multiple stakeholders can be considered a strong driving force in the implementation of circularity/innovation.	

2. Synchronising national regulations with EU requirements

In recent years, EU policies focusing on Extended Producer Responsibility (EPR) for plastics have been issued, including the Directive addressing environmental emissions from single-use plastics (EU) 2019/904 and the Waste Directive promoting EPR (EU) 2008/98/EG. EU requirements have had a relevant impact on the creation of plastics regulations and laws in Germany. Germany's orientation towards meeting EU requirements while maintaining national environmental standards has led to the introduction of a number of new policies (Kumar, 2021). For example, EU regulations stipulate that all plastic packaging must be recyclable by 2030. In line with the EU regulation, the German Packaging Act, which is to be implemented in 2019, sets a fixed recycling target quota, of which the quota for 2022 is set at 63% (Packagingeurope, 2018). With a clear target for packaging recycling, Germany is well on its way to implementing it from 2019 (Kumar, 2021). Furthermore, as EU regulations are frequently updated and revised, German policy has managed to keep pace with this dynamic (Kumar, 2021).

Identifiable description	**Implementation progress**
The EU mandate that all plastic packaging must be recyclable by 2030 clearly supports the implementation in Germany and other EU countries.	Positive

3. Regulatory transparency and legislation in the (plastics) packaging supply chain

In the Packaging Act to be implemented in 2019, an innovation is introduced, namely a national platform involving all players in the packaging supply chain. At its heart is packaging data management. In order to implement it, each producer is responsible for registering product information online and all the data collected is centralised. More importantly, all producers are required to report product details such as the type of material and the quantity of product. All companies, regardless of their size, are obliged to participate in the management of packaging data. In addition, a monitoring system is in place to oversee the recovery and recycling of packaging waste. At the same time, fines of up to €200,000 are imposed in the event that actors fail to comply with the requirements (Schroeder & Jeonghyun, 2019).

Identifiable description	**Implementation progress**
This fact illustrates the strict regulation of the German packaging industry and the cooperation of companies. Its implementation is in progress.	Ongoing

4. Sector- and firm-specific innovation support policies

A number of policies have been introduced to support the implementation of circular plastics in Germany (Bukowski & Rok, 2020). Regardless of the scale of the innovation, these policies contribute to the implementation of recycling in Germany (Bukowski & Rok, 2020).

A typical provision is the requirement that individual companies in the plastics industry should establish advisory departments. Therefore, relevant training is regularly provided to designated officials (DE AbfBeauftrV, 2016). Furthermore, the Commercial Waste Regulation has been implemented and companies are obliged to sort plastic waste in order to achieve a high recycling rate (GewAbfV, 2017).

In Germany, the ban on the use of PVC in landfills has stimulated recycling innovations for PVC in Germany (e.g. window solutions from Rehau AG). Environmental product declarations (EPD standard EN15804) are regulated to trigger innovations in circular product design. EPBD 2010/EnEV 2018 (Energy Efficiency in Buildings) has been published to support circular innovations in the building sector.

Identifiable description	Implementation progress
Regardless of the scale of the innovation, these policies have contributed to the implementation of circularity in Germany.	Positive

3.2.1.2 Civil society

A variety of innovations to tackle plastic waste can be found in Germany. According to a study by Wilts et al. (2020), German innovations in plastic waste relate to these areas: consulting, establishing reuse activities, product design, research and education. Also included in the study is a case study of PVC recycling for construction in Germany. Some of the relevant innovations are presented and described below.

1. The regional authorities create an advisory platform for individual companies

The "Schön wie wir" (i.e. advice on recycling plastic innovations) is mainly brought about by the regional authorities. This approach is somewhat more convincing and reliable than projects initiated by individual companies, because the authorities are very committed to implementation. As a result, a number of SMEs and start-ups have been involved through the advice provided by Schön wie wir (Wilts et al, 2020) and have made tentative attempts at their business objectives. In addition, the popularisation of plastic reuse has taken shape on the basis of the active participation of many parties. And a number of further implementations by individual companies will be developed to scale up the innovation.

Identifiable description	Implementation progress
A number of small and medium-sized	Positive

enterprises and start-ups have been involved and have made initial attempts at their business objectives through the advice provided by Schön wie wir.	

2. ***Emerging consumer behaviour change programmes***

It is tough to change consumer behaviour as it is linked to a variety of factors such as psychological and social factors. However, to address this issue, we have designed and implemented a pioneering project (i.e. a reusable plastic bag pick-up station). It works by allowing consumers to pick up reusable plastic shopping bags for free and return them with their next purchase. The project works with local supermarkets and the collection stations are usually set up at the entrance and vegetable corner of the supermarket with clear placards informing consumers. Consumers tend to prefer the free reusable plastic bags to the paid disposable plastic bags. In addition, reusable plastic bags are designed to be flexible and waterproof, which can attract consumers' attention.

Identifiable description	**Implementation progress**
Programmes to change people's behaviour have been launched and their implementation (e.g. people' acceptance of reusable products) is underway.	Ongoing

3. ***Product design triggers system change (lifestyles, business models and supply chains) towards circularity***

Product design can have a special power to change people's lifestyles, and RECUP is a good example of this in the provision of a cup reuse service (recup, n.d.). Firstly, it sets its target group as people in cities and municipalities with a high demand for coffee. At the same time, the focus on coffee is a good starting point for a packaging reform on a global scale. The main principle at work is that customers buy their coffee in reusable cups and are charged a fixed monthly fee.

The question arises here as to why customers are willing to pay for reusable coffee cups. The key lies in the design. It is not only in the cup itself (e.g. durable plastic material with mineral coating, attractive design, modular design), but also in the services surrounding the cup (e.g. cleaning service, deposit system) (recup, n.d.), which have the potential to attract stakeholders. With regard to the design of the cup, it is designed as a durable, interchangeable modular component (i.e. lid and body) and uses recyclable plastic so that the cup can last longer and is able to change components to increase its lifespan and eventually be recycled. This design approach follows the principle of circularity, or what could be called circular product design (Den Hollander et al, 2017). At the same time, the services around the coffee cup are designed towards

circularity and involve multiple stakeholders such as product designers, cup manufacturers, coffee shops and restaurants as well as consumers. So far, RECUP has been accepted by many consumers, especially urban citizens, and it is expanding to different places and targets (Wilts et al, 2020). Furthermore, RECUP was transferred to South Africa for development in 2019 (Wilts et al, 2020).

Identifiable description	Implementation progress
To date, RECUP has been accepted by a lot of consumers, especially urban dwellers, and it is expanding to different locations and targets.	Positive

4. ***Joint implementation in different industries (e.g. food packaging industry and tourism industry)***

To tackle the problem of marine plastic waste, NABU is a pilot project for reusable packaging, where the main participants are restaurants and customers. It works by giving customers the opportunity to choose between traditional disposal containers and reusable takeaway containers. Choosing reusable packaging offers consumers the possibility of a discount on their next purchase. Also, the breaking point is that NABU is generated in coastal communities, which is an attraction for tourists. Many tourists from around the world have proven to be involved and reusable packaging products are effectively put to use (Wilts et al, 2020). In this way, the reusable campaign has spread through the German tourism community. In addition, a number of other coastal communities have started similar schemes to offer reusable packaging to their customers.

Identifiable description	Implementation progress
Many visitors from all over the world participated and reusable packaging products were put to effective use.	Positive

5. ***The emergence of innovations based on collaboration between individual companies and research institutes***

Some everyday innovations may seem trivial, but they can create organisational change. A project to reduce the use of stretch film was carried out in Germany. The main working principle is to replace disposable stretch film with reusable cords to protect fragile packaging (e.g. glass containers) in reusable packaging transport (Wilts et al, 2020). This project was developed by the organic wholesale company Kornkraft Naturkost and the Institute for Social Ecology (Wilts et al, 2020). The communication and trust between the research institute and the individual companies is the key to this project. This innovation is not considered a huge change, but it can save some material

costs and about one hour of work per day per year (Wilts et al, 2020). The economic feasibility and scaling up of this project is currently being assessed and undertaken.

Identifiable description	Implementation progress
The collaborative project between the company and the research institute is underway. The economic viability of this project and options for scaling it up are currently being evaluated.	Ongoing

6. ***Difficulties encountered by consumers in disposing of plastic packaging***

A survey in Germany shows that around 60% of people believe that information on the disposal of packaging is not sufficient (Packagingeurope, 2018). At the same time, more than 30% of consumers do not manage to dispose of packaged products (Packagingeurope, 2018). Instrumental information such as how to dispose of plastic packaging seems to be more relevant for guiding consumers' recycling behaviour than general information on packaging relative to environmental labelling.

Identifiable description	Implementation progress
Around 60% believe that information on handling of packaging is inadequate and over 30% of consumers do not manage to handle packaged products	Negative

3.2.1.3 Individual enterprise

1. ***A closed-loop supply chain for plastics (i.e. PVC)***

Rehau AG's window solutions involve multiple actors in order to achieve circularity in Germany. The different actors work together to create a value chain in which downstream actors (e.g. customers and recyclers) are highlighted (r2piproject, 2020). This type of cooperation is innovative and enables the recycling of plastics by closing the loop of PVC. The closed-loop PVC supply chain leads to cost advantages for PVC recyclables, which include material savings and high competitiveness on the market. The diagram below illustrates the circularity described.

The main players in the closed-loop PVC supply chain can be identified as. Rehau, profile manufacturers and window manufacturers, PVC recyclers, window installers and end customers.

Rehau has an advisory role in this innovation. For large sites or customers, Rehau may negotiate directly or contact strategic intermediaries to ensure that their specifications are in line with their product type. At the same time, Rehau sells its

products to window installers to demonstrate the benefits of its products and to provide technical advice on installation.

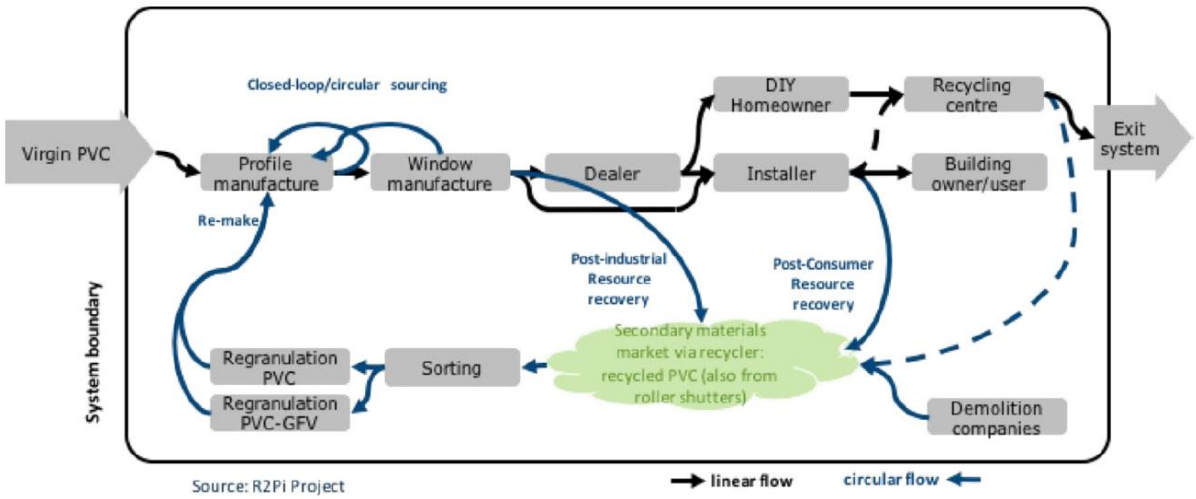
Together, profile manufacturers and window manufacturers play a pivotal role. This is not difficult to understand, as profile manufacturers and window manufacturers are responsible for key stages, including the reworking of fibreglass PVC frames (i.e. PVC profiles and windows from PVC recyclers), putting them back into production and selling them as final products (r2piproject, 2020). In addition, profile manufacturers and window manufacturers are committed to coordinating with other actors, such as PVC recyclers, window installers and end customers (e.g. building dealers).

PVC recyclers focus on the recycling of PVC. both PVC recyclers and competitors are involved, with the former producing fibreglass PVC recyclates with unwanted components and the latter wanting pure fibreglass PVC recyclates. To solve this problem, Rahau has adopted a special tracking and sorting technology (i.e. GmbH's tracking and sorting technology) that enables the application of fibreglass PVC recyclates. In particular, the Dekura plant in Germany offers advanced technology for sorting PVC.

The work of window installers includes training and support in the correct planning, installation and use of the products, as well as recycling schemes for installed windows.

The end customers cover a large number of industries. New stakeholders, such as builders, have been attracted to the process, which tends to expand circularity (r2piproject, 2020).

To date, Dekura (a 75% subsidiary of Rehau) has successfully processed approximately 55,000 tonnes of waste PVC and reuses approximately 45,000 tonnes of PVC recyclables per year for the market (r2piproject, 2020). In addition, Dekura generates revenues of approximately €30 million per year at an average price of €750 per tonne of recyclables. The majority of its sales are outside the Rehau Group (r2piproject, 2020).



Materials and value streams map (blue arrows: circular values; black arrows: linear values) (r2piproject, 2020).

Identifiable description	Implementation progress
Dekura manages to process approximately 55,000 tonnes of waste PVC per year and reuse approximately 45,000 tonnes of PVC recyclables for the market. In addition, Dekura generates an annual revenue of approximately €30 million at an average price of €750 per tonne of recyclables.	Positive

2. ***The important role of consulting in supporting individual businesses***

"Schön wie wir" is an innovation for recycling plastics that was supported and initiated by the district government. The role of consultancy is very important in this innovation, which provides strategies for the reuse of plastics, and two companies (i.e. CRCLR and coopolis) are engaged in this work. The main working principle was to reduce food and packaging waste associated with multiple actors such as cafes, restaurants and food stalls. The results of the project were good, with more than 200 local SMEs participating in the consultation and several of them being further developed (Wilts et al, 2020). More importantly, consumer acceptance of reusable packaging has increased as a result of the consultation.

Identifiable description	Implementation progress
The results of the project performed well, with over 200 local SMEs participating in the consultation, several of which have been further developed.	Positive

3. ***Incentives for individual enterprises to promote the implementation of circular business models***

In order to participate in plastic reuse activities, the associated savings attract individual businesses. The main savings are lower wholesale prices and a reduction in the amount of packaging purchased due to reduced disposal (Kramm et al, 2018). In turn, these incentives are attractive to individual businesses and are particularly adaptable to new actors who are not yet aware of the plastics reuse supply chain. The Zero Waste Shop demonstrates a typical example in Germany with a range of achievements (Kramm et al, 2018). A series of communication materials were distributed and training workshops were organised to disseminate the zero-waste business model (Wilts et al, 2020). In addition, another example is RECUP, which includes a monthly coffee fee of €30 from consumers who buy reusable plastic coffee

cups (recup, n.d.). At the same time, savings are made on the cost of disposable cups (Wilts et al, 2020). More detailed information on RECUP is presented in a separate section on product design triggering system change.

Identifiable description	Implementation progress
These incentives are attractive to individual businesses and are particularly adaptable to new actors who are not yet aware of the plastics reuse supply chain. The Zero Waste Shop demonstrates a typical example in Germany with a range of achievements. A range of communication materials were distributed and training workshops were organised to disseminate the zero-waste business model.	Positive

4. ***Improper waste handling at individual companies***

The German company Greendot operates an Extended Producer Responsibility system in the production of plastics. However, the company claimed that they had paid for circularity solutions and rejected third party circularity services (i.e. TerraCycle). However, it turns out that Greendot carries out plastic incineration, not plastic circularity (Bukowski & Rok, 2020).

Identifiable description	Implementation progress
It was revealed that Greendot carries out the incineration of plastics, not the cycling of plastics.	Negative

3.2.2 Indonesia

3.2.2.1 State

Firstly, the policy focusing on waste recycling is not fully implemented, but the main implementation is based on the provisions of waste management. This is because the implementation of waste reuse is still at an early stage in Indonesia. For example, the policy of Extended Producer Responsibility (EPR) was introduced in 2020 and its implementation has not been assessed in the available literature. The policies related to waste management are described below.

The Indonesian government has progressively improved national waste management laws and regulations to achieve the stated targets of 30% waste reduction and 70% waste disposal by 2025 (Ministry of Environment, 2020.) National laws enacted prior to 2010 include Solid Waste Management (UU No. 18/2008) and Environmental Protection and Management (UU No. 32/2009). Law No. 18/2008 on

Waste Management is the core policy on waste management in Indonesia. Law No. 18/2008 regulates a range of waste management activities, including the recycling and reuse of waste (Government of Indonesia, 2008).

In 2012 and 2014, the government introduced regulations following the enactment of national laws, including the Management of Household and Household-like Waste (PP No. 81/2012), and the Management of Hazardous Waste (PP No. 101/2014) (MoEF, 2020). In order to follow up, a number of policies have been issued at both national and local levels. A few typical policies are described below. National Policy and Management Strategy for Domestic Waste and Similar Domestic Waste (Bulletin No. 97/2017), Marine Waste Management (Bulletin No. 83/2018), Income Tax Facilities for Investments in Certain Business Areas and/or Certain Regions (Bulletin No. 18/2015), Acceleration of Damage and Pollution Control in the Catarum River Basin (Bulletin No. 15/2018), Acceleration of development of waste-to-energy installations using environmentally sound technologies (Bulletin 35/2018) (MoEF, 2020). In particular, the Extended Producer Responsibility Regulation (MoEF, 2020) has recently been published.

1. ***Decentralisation of regulations and policies on waste management to Indonesian city governments and citizens***

Law No. 18/2008 on waste management defines the responsibilities of national, provincial and city governments in Indonesia (Khair, 2019). In particular, city governments are eligible to establish a waste management forum that includes communities, research institutions, environmental agencies, individual businesses, etc. This forum is primarily intended to provide advisory services on waste management (Government of Indonesia, 2008). In addition, city governments have the capacity to improve waste treatment facilities and monitor waste treatment (Government of Indonesia, 2008). For example, the city government of Medan has introduced several policies on waste management (e.g. Mayor's Regulation No. 1/2017) to support the operation of local waste management systems (Khair, 2019). In addition, not only financial support from the municipality but also tariffs from citizens support the waste infrastructure in Indonesia (Pemerintah Kota Medan, 2012). Tariffs are set based on local regulations and information from citizens (Pemerintah Kota Medan, 2012).

Identifiable description	**Implementation progress**
The Municipality of Medan has introduced several policies on waste management (e.g. Mayor's Ordinance No. 1/2017) to support the operation of the local waste management system. In addition, not only financial support from the municipality, but also tariffs from citizens have supported Indonesia's waste infrastructure.	Positive

2. ***Launching and supporting a range of plastic waste management schemes through state intervention***

The Indonesian government has launched a number of schemes to improve plastic

waste management in the intervening years. An exemplary case is the additional charge on plastic packaging in 2019, and another is the Ministry of Environment and Forestry (MoEF) launching a 'Waste Segregation Campaign' to promote optimal sorting of plastic sources. In addition, the authorities have set off pilots to recycle PET packaging in different regions. In addition, the Ministry of Public Works and People's Housing (PUPR) initiated the use of re-milled shopping bags as an alternative, based on a study of bituminous plastics (Rival et al, 2018).

Identifiable description	Implementation progress
The initiatives and plans are here, but no concrete implementation has been found.	No concrete data

3. Waste data monitoring implemented by local and national governments

Local governments have played an active role in the implementation of waste management. For example, the local government of Bogor introduced the "Reduction of Plastic and Styrofoam Use" (i.e. No. 13/2019) to address local plastic waste management. During implementation, waste reduction data needs to be tracked and monitored by the Ministry of Environment and Forestry (MoEF, 2020). In addition, several cities in Indonesia have initiated similar waste monitoring schemes (e.g. ADIPURA) to address urban waste management issues (MoEF, 2020).

Identifiable description	Implementation progress
Relevant data for the specific implementation of these descriptions were not found.	No concrete data

4. Poorly enforced policies on waste management

The Indonesian government has issued a number of policies to deal with plastic waste, but the results have not been as effective as expected. Some relevant policies have proven to be ineffective due to lack of policy implementation (Poggenpohl, 2018). For example, the Law on Solid Waste Management (No. 18/2008) was introduced to deal with solid waste management, which mandated the cessation of dumping for disposal by 2013, however, this goal was not achieved and many dumping sites are still in operation (SIPSN, 2018).

Identifiable description	Implementation progress
Some of the relevant policies have proven to be ineffective due to lack of policy implementation. For example, the Solid Waste Management Act (No. 18/2008) was introduced to deal with solid waste management, which provided for the cessation of waste	Negative

dumping by 2013; however, this target has not been achieved and many dumping sites are still in operation.	

5. ***National and international cooperation on plastic waste management organised by the government***

The Ministry of Environment and Forests (MoEF) undertakes a number of national and international collaborations on the management of marine plastic waste (MoEF, 2020). For example, in 2019, several national agencies established Memoranda of Understanding (MoUs) on marine pollution in a range of areas. More importantly, the Indonesian government cooperates with the Association of Southeast Asian Nations (ASEAN) on marine waste disposal (MoEF, 2020).

Identifiable description	Implementation progress
Relevant data for the specific implementation of these descriptions were not found.	No concrete data

3.2.2.2 Civil society

In Indonesia, there are already several cases of plastic reuse and upgrading, initiated by actors from civil society and individual businesses. According to the World Economic Forum (2020), these cases can be divided into different themes: new business models, innovation and integration of the informal sector, waste management improvements, communities and partnerships, empowerment activities and research. Distinctive characteristics will be identified from the descriptions of these cases.

1. ***People's waste disposal practices violate the principle of circularity***

In Indonesia, a large amount of waste is still being dumped in the environment, despite the regulations and initiatives in place. One study showed that people are not willing to pay the monthly waste disposal fee, but they insist on dumping their waste (Benny & Zaenal, 2017). This situation indicates that it is difficult for people to engage in circular activities.

Identifiable description	Implementation progress
Despite the regulations and initiatives in place, large amounts of waste are still being dumped in the environment. A study has shown that people do not want to pay the monthly waste disposal fee, but they insist on dumping their waste.	Negative

2. ***Individual companies' and customers' perceptions of the safety of reusable plastics***

Individual food companies and consumers are concerned about safety issues regarding reusable packaging due to the lack of regulations regarding the hygiene of reusable plastics (e.g. contamination) (Bor, 2020). This may hinder company initiatives and customer acceptance. This issue arises when consumers who have used the packaging leave contamination behind and the packaging cleaning operations are not well carried out. In reality, this issue is largely based on the perceptions of individual businesses and consumers, rather than actual implementation. This negative perception by individual businesses and consumers of the food safety aspects of reusing plastic packaging may hinder business decisions and consumer acceptance.

Identifiable description	**Implementation progress**
The negative perception by individual businesses and consumers of the food safety aspects of reusing plastic packaging may hinder business decisions and consumer acceptance.	Negative

3. ***Cooperation in the establishment and widespread implementation of a waste bank in Medan***

The concept of waste banking is based on the 3R principles (i.e. reduce, reuse and recycle). In Indonesia, waste banking activities have played an important role in the reuse and upcycling of plastics. Waste banks in Medan are divided into institutions, schools and communities, where services to turn recyclable solid waste (e.g. paper, plastic, organics, glass, metal, etc.) into money are carried out. As of 2017, there were 97 waste banks operating in Medan (Dinas Lingkungan Hidup Kota Medan, 2017).

The first waste bank was established in Medan, Indonesia, in 2014 as a partnership between the Medan government and Kitakyushu, Japan, supported by the Japan International Cooperation Agency (JICA) (Dinas Lingkungan Hidup Kota Medan, 2016).

Local governments and NGOs have provided specific operational training for waste bank labourers. For example, the NGO-run Sicanang Waste Bank also supports the establishment of other waste banks in collaboration with local governments (Khair, 2019). In addition, the Medan City Department of Environment and the Medan City Department of Cleanliness and Parks have provided financial support for the operation of the Sicanang Waste Bank (Khair, 2019).

Identifiable description	**Implementation progress**
As of 2017, there were 97 junk banks in operation in Medan	Positive

4. ***Multi-stakeholder school waste cycling education***

Primary and secondary school education plays a major role in influencing children's future, and therefore it is crucial to teach them about the environment at this age. In Indonesia, an environmental education programme (i.e. Green Indonesia) on packaging (e.g. beverage packaging, food packaging, disposable products, etc.) is expected to have a great impact when conducted in primary and secondary schools

(Wilts et al, 2020). It aims to teach children about proper waste disposal and reuse, as well as relative knowledge about the circular economy (Wilts et al, 2020).

In order to implement environmental education in primary and secondary schools, school teachers need to be trained in relevant knowledge by local government agencies (i.e. the environment and education departments) (Wilts et al, 2020). Students are the core target group for this project. Also, the children's family members, relevant organisations from civil society (i.e. Indonesian Plastic Recycling Association) and plastic producers were involved to support the children's education (Wilts et al, 2020). In addition, the school's teaching surroundings, such as students' families and the community, spread acceptance of reusable products through positive communication and dissemination through the reusable products distributed to students (e.g. water cups for refilling and the installation of affordable water filters for low and middle income families) (Wilts et al, 2020).

Primary and secondary schools have proven able to manage to act as waste collection points for schools and communities, while Green Indonesia has worked with local authorities to upgrade waste collection systems and install waste bins (Wilts et al, 2020). In 2019, the Indonesia Waste Platform (IWP) team set up collection points for recyclable plastics in 15 schools in Labuan Bajo and worked with the plastics recycling sector to deliver these materials to Java (Wilts et al, 2020).

Identifiable description	**Implementation progress**
Primary and secondary schools have proven to manage to act as a waste collection point for the school and the community.	Positive

5. ***Cooperation between international stakeholders and local authorities leads to reduction of marine plastic waste***

The STOP project was established in 2017 by multiple stakeholders including international organisations (i.e. SYSTEMIQ and Borealis), the Norwegian government and local authorities in Indonesia. It aims to address marine plastic pollution in Indonesia and works on the principle of establishing municipal partnerships to design and implement waste management.

STOP was first implemented in 2018 in Muncar (a coastal city in Indonesia), where household plastic waste is creating a serious problem due to direct dumping activities. The limited waste services in Muncar are the core issue. To address this, STOP not only provided short-term measures to promote public participation in addressing waste collection and segregation, but also developed a long-term strategy to improve the product design of waste facilities (Stuchtey et al, 2019). As a result, marine plastic spills have been effectively reduced (Stuchtey et al, 2019).

Identifiable description	**Implementation progress**
The ocean plastic leakage was effectively reduced	Positive

6. ***Issues surrounding informal waste disposal workers***

Landfills in Indonesia are home to a large number of informal waste workers who make a living by scavenging. For example, in Bantar Gebang only (the largest landfill in Indonesia), there are 6,000 waste pickers (CNA, 2020). Due to the high profitability of recycled materials, a large number of informal waste actors are involved in collection and trade (Stuchtey et al, 2019).In this regard, changes to landfills can have a significant impact on their livelihoods, so this poses a challenge to policies that introduce landfill improvements. Furthermore, for these informal waste workers, they face serious work problems, as informal waste workers will become less efficient as recycling companies raise their standards for recycled materials, especially plastics. Approximately 40% of informal waste workers have their job content rejected by recycling companies, not to mention the fact that it is dirty and laborious work for them (CNA, 2020).

Identifiable description	**Implementation progress**
From the point of view of informal waste workers, their efficiency is decreasing, which has a negative impact on the circularity of (plastic) waste.	Negative

7. Organising community events to tackle the plastic recycling problem

A number of community events have been found in Indonesia that address the issue of plastic recycling.

Another breakthrough in the STOP project was the creation of community activities by involving multiple stakeholders in Indonesia. Firstly, a number of community activities (i.e. BUMDES) were set up to deal with community waste disposal and trade in recyclable plastics. Secondly, practical trainings and events such as beach clean-up campaigns were organised to address marine plastic pollution (Stuchtey et al, 2019). In addition, over 100 new jobs were created at community events to reuse and upcycle plastic waste (Stuchtey et al, 2019).

Other examples are as follows.The Zero Waste Cities Programme in 2018 has achieved community engagement by separating waste from landfill (WEF, 2020). In Labuan Bajo, a local cooperative applied a mock waste bank model to engage people (WEF, 2020). A women's charity contributed to the dissemination of reusable nappies (WEF, 2020). The religious organisation Nahdlatul Ulama carried out Islamic instructions on plastic waste disposal, which largely influenced people's behaviour. For example, some Islamic workers started making household items (e.g. stools) from plastic waste (WEF, 2020).

Identifiable description	**Implementation progress**
Over 100 new jobs created in community activities to reuse and upgrade plastic waste	Positive

8. Research activities to address the plastic waste problem

Indonesia has established many research platforms to address the plastic waste problem. One of these is the Indonesian Waste Platform, which was established in 2015

and includes more than 1,000 organisations providing waste solutions (WEF, 2020). In addition, several associations dealing with plastic waste (e.g. BPJS, IP2WM, PRAISE, ADUPI) are active in specific areas of plastic waste management (e.g. integration of formal and informal sectors, improvement of plastic recycling technologies, plastic manufacturing) at national and local levels (WEF, 2020). At the same time, Indonesian scientific research institutes and universities (e.g. ITB, Udayana, ITS) also conduct research on data on plastic waste (WEF, 2020).

Identifiable description	Implementation progress
Indonesia has undertaken research activities in waste management, but it is not clear whether it has contributed to circularity	No concrete data

3.2.2.3 Individual enterprise

1. ***A shift from sustainability to circularity is occurring based on the commercial considerations of individual companies***

Multinational FMCG companies have played a central role in plastic reuse activities in Indonesia (Bor, 2020). Several large companies (e.g. Danone, Nestlé, Unilever) have launched their own agendas for dealing with plastic waste and have conducted a number of plastic recycling pilots in Indonesia.

Sustainable packaging is an initial goal of FMCG companies, whose main objective is to reduce the environmental emissions of packaged products. Bioplastics are a prime example of sustainable packaging, used to improve the environmental performance of plastic packaging. In contrast to sustainable packaging, circular packaging as an innovation illustrates new economic and environmental benefits, such as new jobs and cost savings in circular supply chains, as well as promising emission reductions based on the concept of circularity. As a result, sustainable business models are gradually shifting to circular business models, with reusable plastic packaging being considered a prime example of the latter.

The business model of plastic recyclability needs to be primed in order to address the issue of fund scaling and consumer acceptance, and Hepi Circle presents a typical model start-up aimed at replacing single-use pouch packaging with reusable packaging. To address the issue of returns and lack of funding, Hepi Circle created a digital platform to operate the delivery and cleaning of reusable packaging, targeting high income households (Bor, 2020). This target group setting led to Hepi Circle's initial success in terms of consumer acceptance, where communication between the company and the consumer and the design of the product was highlighted (Bor, 2020).

In addition, other examples of recycled plastics were presented. One example is the 100% recycled plastic bottle that Aqua is launching in 2019. Rather than stopping the use of plastic altogether, the plastic itself can be 100% recycled with technical support. This innovation clearly offers an option to reduce the use of plastic, and importantly the former has extremely low environmental emissions. Another example is the reusable plastic containers for takeaways (e.g. MUUSE), which involves restaurants and consumers germinating in Indonesia and changing the way people live.

Identifiable description	Implementation progress
Some large companies (e.g. Danone, Nestlé, Unilever) have launched their own agendas for dealing with plastic waste and have piloted a number of plastic recycling initiatives in Indonesia.	Positive

2. ***Household waste services in Indonesian cities***

In Indonesian cities there is no need for households to segregate waste, but some waste collection services have been initiated and implemented from the informal waste sector (Khair, 2019). For example, in Medan, a door-to-door service was initiated to collect and sort waste in urban areas and its services also cover public areas (Khair, 2019). In the suburbs, waste is transported to certain locations and then incorporated into municipal landfills managed by the municipality (Khair, 2019). In addition, transport facilities are allocated to each urban area (Khair, 2019). However, the quality of services in Indonesia is low due to the limited economic sustainability of infrastructure and waste management, which naturally reduces the support of the citizens (Khair, 2019). Also, the lack of people's participation has in turn hindered the implementation of household waste services (Khair, 2019).

Identifiable description	Implementation progress
The quality of waste management services in Indonesia is low due to limited infrastructure and economic sustainability. The lack of popular participation also hinders the implementation of household waste services.	Negative

3. ***Technology upgrade for waste management by individual companies supported by local government***

Digital technology is being applied to waste treatment operations in Indonesia. Individual companies Gringo, Smash, MallSampah, Obabas and others are working on digitisation of waste treatment to improve the efficiency of waste treatment (WEF, 2020). In particular, many of the companies involved are start-ups. Key efforts also include improving the efficiency of waste collection and linking waste information to communities (WEF, 2020). These activities are encouraged and supported by the local authorities with corresponding incentives. Also, the local government supports facility improvements such as equipping waste disposal with sorting conveyors and plastic shredders (e.g. TPST Bakti Bumi in Sidoarjo) (WEF, 2020). In this way, Merah Putih Hijau in Bali implemented a community partnership to enhance waste facilities (WEF, 2020). In addition, labour training for upgrading technologies was conducted by multiple stakeholders.

Identifiable description	Implementation progress

Individual companies are committed to the digitisation of waste treatment in order to increase the efficiency of waste treatment. Local authorities support improvements in facilities such as sorting conveyors and plastic shredders in waste treatment.	Positive

4. ***Improving job satisfaction for waste operation workers***

In Indonesia, waste operation workers are often underpaid under low conditions, a situation that is even worse in the informal sector (WEF, 2020).Waste4Change and EcoBali are committed to waste collection and they focus on improving the working environment for waste operation workers (WEF, 2020). As a result, the efficiency of waste collection has increased as a result of increased worker satisfaction. In addition, the 'plastic bank' offered a high price for the collected plastic, which increased the activity of the waste workers (WEF, 2020). Furthermore, with the support of the government, the wages of waste workers in Jakarta increased in 2016, thus improving job performance (WEF, 2020).

Identifiable description	**Implementation progress**
The efficiency of waste collection has improved due to higher worker satisfaction. With the support of the government, the salaries of waste operation workers in Jakarta were increased in 2016, resulting in improved job performance	Positive

3.3 Innovations in the pulp and paper industry

3.3.1 Sweden

3.3.1.1 State

As the Swedish government has implemented a number of policies that have facilitated the promotion of the energy transition in the pulp and paper industry, their effectiveness is mainly based on the national level. EU policies on energy efficiency and climate change have influenced policy decisions in Sweden, but the impact on national policies is considered to be greater (Scordato et al, 2018).

1. ***Implementing a series of environmental regulations of the pulp and paper industry***

Since the 1960s, the Swedish government has issued a number of policies to address

the environmental problems posed by the pulp and paper industry. The regulation of individual permits is considered to be the first implemented policy to effectively reduce environmental emissions from the pulp and paper industry in the late 1960s (Scordato et al, 2018). To achieve success, further policies were introduced in terms of sustainability of production and consumption, such as requiring the use of chlorine-free paper, while improving the quality of paper products (Soderholm et al, 2017).

After the 1990s, the policy focus was on climate change, where a number of environment-related taxes and charges were issued (e.g. CO2 taxes, NOx charges). However, the Swedish pulp and paper industry was not greatly affected by climate-related policies, but achieved an energy efficiency transition (Scordato et al, 2018). Between 1973 and 1990, a fundamental change in the fuel and energy mix (i.e. from fossil fuels to renewables) was applied in the Swedish pulp and paper industry and triggered significant emission reductions (Bergquist & Andersson, 2013). To support the energy transition in the pulp and paper industry, environmental regulations and energy policies have played a key role in Sweden (Scordato et al, 2018).

Identifiable description	**Implementation progress**
The regulation of individual permits is considered to be the first implemented policy to effectively reduce environmental emissions in the pulp and paper industry in the late 1960s. From 1973 to 1990, a fundamental change in the fuel and energy mix (i.e. from fossil fuels to renewable energy) was applied in the Swedish pulp and paper industry and triggered huge emission reductions.	Positive

2. State intervention in individual enterprise innovation

Companies in the Swedish pulp and paper industry are used to solving environmental problems through internal process adjustments rather than innovative technologies (Söderholm & Bergquist, 2013).Domsjö/MoDo is a typical example of such companies, whose internal problem solving methods were established in the 1940s. This can create barriers to innovative applications in individual companies and hinder the environmental transformation of the pulp and paper industry. To address this problem, the Swedish authorities have developed a policy for the application of biological treatment technology in individual companies. Clear requirements and adequate subsidies have been implemented. However, for companies such as MoDo it is difficult to meet the established environmental requirements at the beginning. In order to make the process work, government agencies issued a "relaxed prohibition period" policy, which was designed to help companies find strategies and measures to address the gap between environmental criteria and economic feasibility (Söderholm &

Bergquist, 2013).MoDo eventually managed to apply biotreatment technology while meeting the environmental requirements (Söderholm & Bergquist, 2013). As a result, not only is the Swedish government adept at issuing relevant innovation policies, but it is also committed to closely monitoring and facilitating the progress of individual companies in their implementation.

Identifiable description	Implementation progress
MoDo finally succeeds in applying biological treatment technology while meeting environmental requirements	Positive

3. Existing regulations for the reuse of sludge

At the outset, the EU issued an eco-labeling award for soil conditioners (Commission of the European Communities, 2006, para. 1.2), which is indirectly related to waste sludge from the pulp and paper industry. In addition, several Swedish policies address the requirements for the use of sludge waste. For example, the SPCR 120 certification regulates the rules for digestate such as sludge for biowaste in Swedish waste management (Swedish SP Institute of Technology, 2015). Both EU and Swedish policies are promising to support circular innovation in sludge waste reuse in the Swedish pulp and paper industry.

Identifiable description	Implementation progress
Although the number of policies is small, regulations for sludge reuse are beginning to emerge, while at the same time relevant initiatives and planning are already taking place at corporate and civil society level (3.3.1.2; 3.3.1.3, case description). With these forces in place, further relevant policies will be introduced and implemented.	Ongoing

3.3.1.2 Civil society

By 2010, the development of the pulp and paper industry in Sweden had involved huge investments (Ministry of Industry, 2011). This was also due to government subsidies for pulp and paper producers (Obidzinski & Dermawan, 2012). However, considerable financial risk has been shown in the pulp and paper supply chain, as the load on infrastructure construction, operations and supply has become increasingly unsustainable (Obidzinski & Dermawan, 2012).

1. Cross-national cooperation converting the wastewater from pulp and paper

mills into the energy source

Swedish pulp and paper mill wastewater is reused to produce renewable energy. The Finnish energy company Gasum has built a biogas plant at the Nymölla paper mill in Stora Enso (a Finnish-Swedish company) in Sweden, demonstrating the close cooperation between Finland and Sweden (multicopy, 2021). The plant aims to convert the waste water from the Nymölla paper mill into liquefied biogas (LBG), including for various uses. In addition, Gasum is working with multiple stakeholders to produce and supply biogas throughout the Nordic countries (multicopy, 2021). At the same time, the expansion of LBG applications has led to increased participation from pulp and paper mills in Sweden (multicopy, 2021).

Identifiable description	**Implementation progress**
Finnish energy company Gasum has built a biogas plant at the Nymölla paper mill in Stora Enso, Sweden. the expansion of LBG applications has led to increased participation in pulp and paper mills in Sweden	Positive

2. Innovative research project on the application of waste sludge

Multibio is a project funded by a Swedish government agency (Vinnova) and is mainly carried out by the Swedish RISE research institute AB. At the same time, multiple stakeholders are involved in the project due to its high potential. These stakeholders include research institutions (e.g. Lund University, Karlstad University, Swedish University of Agriculture), the pulp and paper industry (Stora Enso Skoghall AB, Rottneros Bruk AB and BillerudKorsnäs Sweden AB), as well as technical service providers (Drinor AB, Fortum Recycling and Waste AB and Gårdsfisk AB) (Pawar et al., 2020).

According to Multibio, waste sludge from the pulp and paper industry shows promising potential. The project was initiated on the basis of research focusing on three uses of waste sludge: fossil-free bioplastics, biohydrogen and fish feed (Recycling Magazine, 2019). These three uses can be carried out in a cascade manner using independent processes and, importantly, they do not affect the normal production of the paper mill in any way. In particular, biohydrogen has a high potential as one of the cleanest fuels and can be applied, for example, in the aerospace industry (Recycling Magazine, 2019). All three potential applications are being studied and research into it is still on a small scale. To date, MultiBio has brought a series of communication events through multiple channels, including 65 national and international media (Pawar et al, 2020).

Identifiable description	**Implementation progress**

The results of the research on the use of waste sludge have been published. The next step is to apply the results of this research in practice to the relevant stakeholders involved.	Ongoing

3. ***Strategic innovation of waste reuse in pulp and paper mill (i.e. Reusing fibre sludge for paint thickener; Reusing Green Liquor Dregs for sealing layers) in collaboration with cross-industry individual enterprises and research support provider (and research institute)***

In the mainstream, waste from Swedish pulp and paper mills, such as fibre sludge, is often used for internal energy production and fossil fuel use. However, the transformation of waste into other new products is fundamentally innovative in Sweden (Auriault et al., 2017). The following two examples are the latter.

A number of strategies have been undertaken to address pulp and paper mill waste. One is the reuse of fibre sludge, which is waste from Swedish pulp and paper mills (i.e. Domsjo Fabriker). The fibre sludge is converted into bioethanol, which is done at Domsjo Fabriker. Two chemical companies (Sekab and Akzo Nobel) are involved in converting the bioethanol into the new ingredient. Sekab first assisted in converting the bioethanol into ethyl chloride and then Akzo Nobel assisted in converting the ethyl chloride into Bermocoll, which is used as a paint thickener. In parallel, a Swedish research support provider (i.e. SP Processum) was responsible for the strategy and overall value chain assessment (Auriault et al., 2017). The diagram below illustrates how this pilot project works.

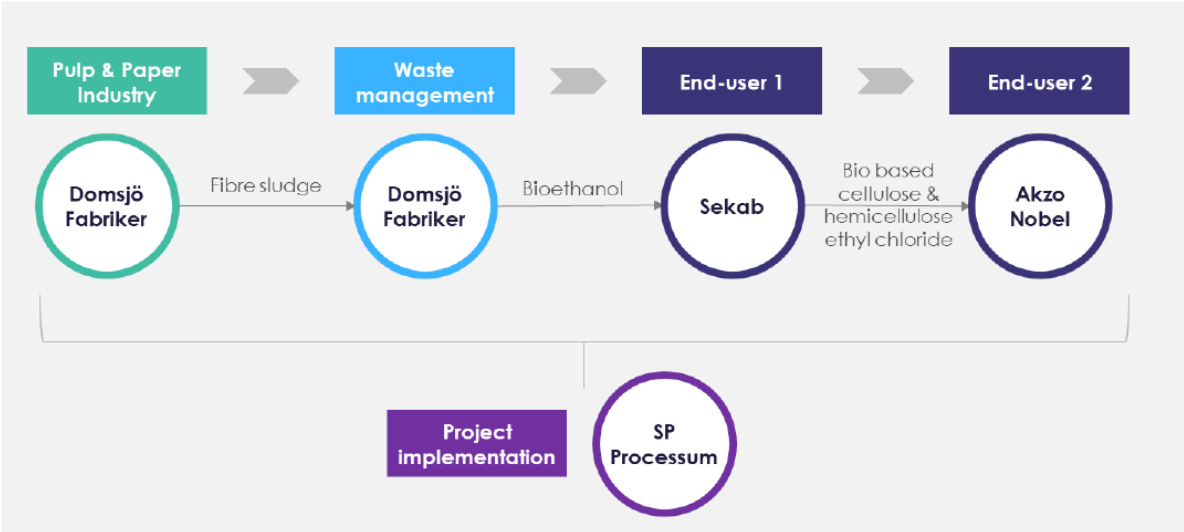


Figure 5: Value chain and stakeholders of Circular Domsjo Fabriker (Auriault et al, 2017)

Green liquor dregs (GLDs) are waste from the pulp and paper industry and have the potential to be used as a sealing layer in the mining industry (Auriault et al., 2017). GLDs waste from sulphate pulp mills is reused. Multiple stakeholders are involved.

Firstly, Ragn-Sells is committed to waste management, converting GLDs into high-quality sealing layers that act as an oxygen and water barrier for the mining industry.The quality control service provided by Ragn-Sells is innovative and equipped with special training (Auriault et al., 2017).Boliden is the mining company involved in receiving the quality-controlled GLDs. In addition, two organisations (i.e. SP-Processum and LTU University) provide monitoring and research services to support the project, which is considered a core strength of this project (Auriault et al., 2017). In addition, it can effectively reduce the landfilling of GLDs currently undertaken for waste management purposes. The diagram below illustrates the whole process of working with stakeholders.

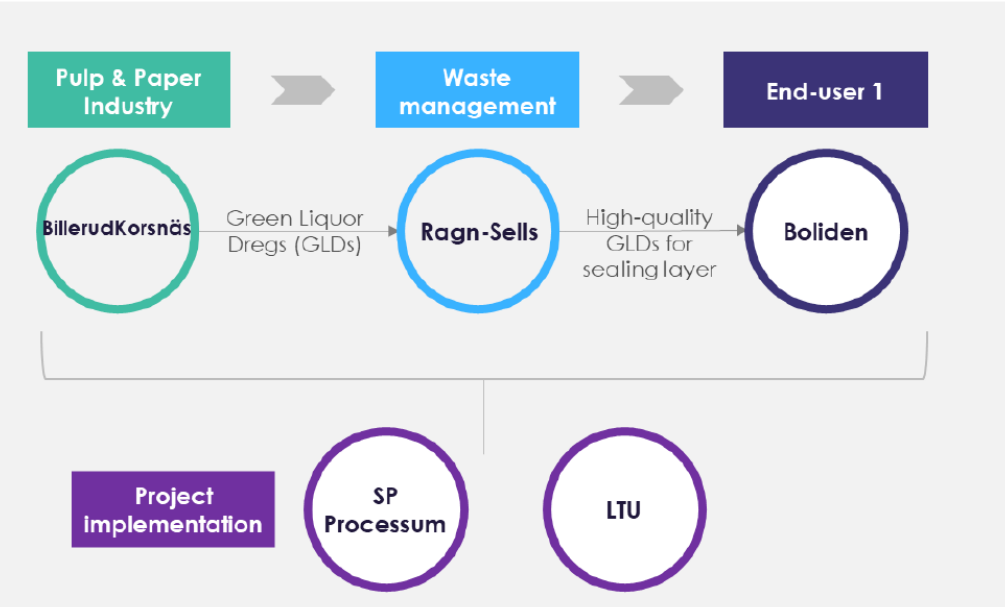


Figure 5: value chain and stakeholders of GLDs reuse (Auriault et al, 2017)

Identifiable description	Implementation progress
Circular strategies involving relevant stakeholders are already in place. Further feasibility analysis is underway.	Ongoing

3.3.1.3 Individual enterprise

1. ***Significant investment in environmental innovation by pulp and paper producers***

In order to address environmental issues in the pulp and paper industry, Swedish producers have made significant environmental investments (Söderholm & Bergquist, 2013). A range of technological innovations have been generated that have helped to address environmental issues. For example, the application of concentrated pulp and paper production facilitated the phase-out of calcium-based sulphite pulp mills in the 1960s, thereby reducing environmental emissions (Wohlfart, 1971). In addition,

environmental research and development is addressing technological innovations that reduce pollution (Söderholm & Bergquist, 2012). For example, emissions of chemical oxygen demand (OCD) were largely cut by environmental R&D consultants in the sulphate pulp and paper industry (SSVL, 1989).

Identifiable description	Implementation progress
Emissions of chemical oxygen demand (OCD) are largely cut by environmental R&D consultants in the sulphate pulp and paper industry.	Positive

2. ***Pulp and paper industry's transition to energy efficiency in response to global competence and electricity market challenges***

In response to global competence, the Swedish pulp and paper industry has successfully transitioned from low energy prices, skilled labour and high quality products to energy efficiency (Rametsteiner et al., 2009), which started in the 1970s. This strategic shift triggered Sweden to have the lowest carbon emissions per unit of product of any pulp and paper industry in the world (IEA, 2007). In addition, deregulation of the electricity market affected the Swedish pulp and paper industry in the 1990s. As deregulation led to high electricity prices and low competitiveness associated with other European countries (Ericsson et al., 2011), energy efficiency was emphasised in the pulp and paper industry to deal with these issues. Furthermore, it has triggered significant investments in energy efficiency and renewable energy systems (Scordato et al., 2018).

Identifiable description	Implementation progress
This strategic shift has led to Sweden having the lowest carbon emissions per unit of product in the pulp and paper industry worldwide.	Positive

3. ***Environmentally friendly paper products produced by local integrated paper mill***

The Nymölla paper mill in Stora Enso in southern Sweden produces wood-free uncoated paper, of which the product Multicopy is a prime example of sustainability (Multicopy, 2021). Firstly, the Nymölla paper mill is a fully integrated mill in which all the main activities for the manufacture of pulp and paper are carried out. Raw materials, for example, are sourced in the immediate area, so transport has a low environmental impact. In addition, excess heat from the mill is provided to the local district heating. In addition, the factory has adopted sustainable forest management, deciding to replant 2-3 trees for every one felled (Multicopy, 2021). At the same time, a traceability system is implemented throughout the supply chain to ensure that environmental requirements supported by authorised organisations (e.g. FSC) are met

at every stage.

Identifiable description	Implementation progress
Corporate initiatives and planning have been demonstrated and implementation is underway.	Ongoing

4. Research-based strategies of individual company in the pulp and paper industry

In Sweden, environmental regulations for individual companies have become increasingly stringent, which does not prevent Swedish companies from moving forward, but their internal R&D efforts are emphasised. Specifically, their environmental objectives are combined with technological innovations, such as new product development based on their R&D efforts.

Fibre sludge is waste from pulp and paper mills and has traditionally been used for energy production in mills and in landfills. Regarding its use in energy production, it is inefficient due to high moisture content (Pöykiö et al., 2018). In fact, the reuse of fibre sludge has many advantages and it has great potential for commercial use, e.g. as a dust binding agent (Leppänen et al., 2020).A study by Leppänen et al. (2020) investigated the applicability potential of fibre sludge for the Finnish and Swedish forestry company Stora Enso. The results show that fibre sludge has a high potential for Stora Enso, which on the one hand could help the company with the problem of storing and disposing of large amounts of fibre sludge and on the other hand would form an image of a circular economy with the company to utilise this waste.

Identifiable description	Implementation progress
The fact that the company has already developed its own circular strategy through specialist research and development is a positive sign, and the relevant implementation work is in progress.	Ongoing

3.3.2 Indonesia

3.3.2.1 State

With regard to the pulp and paper industry in Indonesia, issues related to deforestation are considered to be the main focus due to its severe damage to the environment (Mongabay, 2020; Theguardian, 2016). Therefore, the government has issued a number of policies on land management (e.g. forest management, peatland protection) to address the environmental pollution problems associated with the pulp and paper industry (Thean, 2017).

1. ***Issuing strict land environmental management regulations for the pulp and paper industry***

In 2011, the state initiated a moratorium on the issuance of new logging permits to enforce forest protection, but logging concessions that had been issued prior to this policy were not included in the moratorium (Thean, 2017).After 2015, a number of strict regulations and policies were introduced. Downgrading of those in authority who did not comply with forest protection requirements in designated areas (Thean, 2017). In addition, a policy was issued that required paper companies to initiate projects in collaboration with local communities (Thean, 2017). In addition, government agencies banned new peatland development and related infrastructure construction (Thean, 2017).

Identifiable description	**Implementation progress**
Firstly, the rule of law, accountability and policy enforcement are all negatively represented. Secondly, the strong inconsistency between the policies issued and the actual implementation by companies led to doubts about the relationship between the government and individual companies (e.g. whether there was a relationship of personalisation and particularisation). (4.3.1, discussion)	Negative

2. ***Issuing ecosystem restoration permits to stimulate individual enterprises to meet regulatory requirements***

Since 2007, ecosystem restoration permits for the pulp and paper industry in Indonesia have been issued along with regulated environmental requirements. The permits allow pulp and paper operators to carry out a range of production activities. Some civil society and individual business actors have been stimulated to obtain permits for pulp and paper implementation while meeting environmental requirements (Thean, 2017). For example, Asia Pacific Resources International Holdings Limited (APRIL), a pioneering company in the pulp and paper industry, holds a permit, which in turn has led APRIL to undertake a range of strategies and implementations in the pulp and paper industry (APRIL, 2019).

Identifiable description	**Implementation progress**
The ecosystem restoration permits issued by the Indonesian government	Ongoing

have been effective in providing incentives for individual companies to meet regulatory requirements, although only if there is increased transparency and fairness between the government and individual companies.	

3. Individual enterprise violating regulations and uncertain government responses

The zero forest policy was enacted by the government to protect and restore this peatland. However, APRIL's subsidiary PT Riau Andalan Pulp & Paper (RAPP) was reported by local villagers for illegally clearing peatlands in Sumatra (mongabay, 2020). However, APRIL claimed that their clearing was legal and supported by the Ministry of Environment and Forestry (mongabay, 2020).In early 2016, international NGOs such as WWF and Greenpeace broke with APRIL because its similar canal construction practices were in violation of national laws (Theguardian, 2016). However, the government's response was limited to verbal warnings to APRIL, but no practical measures were taken to stop APRIL's operations.

Identifiable description	Implementation progress
The government's response was limited to verbal warnings about APRIL, but no practical measures were taken to stop APRIL from operating.	Negative

3.3.2.2 Civil society

1. Existing strategic suggestions of circularity from abroad

A number of circularity recommendations can be found for the Indonesian pulp and paper industry. For example, Ian Lifshitz, an expert from Asia Pulp and Paper Canada (APPC), highlights APPC's recycling strategies (e.g. reuse of by-products) that have great potential for application in Indonesia (pulp and paper canada, 2019).Ian Lifshitz envisages that APP's by-products, such as bark and twigs, have a high potential to be converted into biofuels that can be used for a variety of purposes. Other by-products, including silt and residues, could be used as fertiliser for the forest. In addition, according to Ian Lifshitz, various recycling applications for pulp and paper industry by-products in production and consumption are promising, including zero-waste mills, recycled paper products and packaging. These strategies mentioned above are considered to be promising for application in Indonesia.

Identifiable description	Implementation progress
These strategies mentioned above are considered to be promising for application in Indonesia.	Ongoing

3.3.2.3 Individual enterprise

1. ***Individual enterprise establishing the policies, environmental assessment methods, advisory committee and monitoring department to address the sustainable land management***

To achieve sustainable development, the large company Asia Pacific Resources International Holdings Limited (APRIL) has introduced a landscape approach that includes a range of policies (e.g. biodiversity conservation, climate change mitigation and community empowerment) (Thean, 2017). Its implementation focuses on land management, for example, forest management and peatland management in relation to the pulp and paper industry in Indonesia. In addition, this landscape approach has the potential to address land ownership issues in the Indonesian pulp and paper industry.

APRIL has launched the Sustainable Forest Management Policy (SFMP) for sustainable development. The first version was released in 2014 and the second in 2015, in which improving the environmental performance of the timber supply chain is central. An assessment methodology for assessing high conservation value (HCV) and high carbon stock (HCS) in land management was developed in SFMP 2.0 (Thean, 2017).APRIL takes advantage of environmental assessments (i.e. HCV and HCS) to differentiate land values. Low performance in assessment leads to areas of potential industrial use, such that high value land is preserved (Thean, 2017). However, this assessment method has been questioned due to the lack of sufficiently valid environmental criteria (Edwards et al., 2012).

To help APRIL achieve its environmental objectives, a Stakeholder Advisory Committee (SAC) was established with the participation of many people (e.g. institutional researchers, former government officials).The purpose of the SAC was to provide strategies while monitoring APRIL's environmental criteria and to conduct regular monitoring (aprilasia, n.d.). At the same time, APRIL has established an Independent Peat Expert Working Group (IPEWG) of civil society stakeholders to consult and peer review its progress in environmental protection (Thean, 2017).

Identifiable description	**Implementation progress**
We may not know what the outcome of this process will be, but at least it is a positive thing that April was challenged and accepted the advisory committee. Of course, there is still the possibility that April will avoid taking the recommendations seriously. So in the end give a neutral assessment and expectation.	Ongoing

2. ***The existing circular strategies and implementations of individual enterprises***

Existing recycling initiatives are mainly reflected in the strategies and implementation

of large companies such as APP and APRIL (APP, 2020; APRIL, 2019).

These strategies focus on the reuse of by-products in in-house pulp and paper production as raw materials and renewable energy (jakartaglobe, 2020).

In addition, the government has issued waste disposal permits to support recycling implementation by Indonesian companies. In 2018, APP partnered with the local government to reuse a significant amount of by-products (APP, 2020).

In addition, APRIL has partnered with third party service providers such as PwC Singapore to help assess the sustainability impacts of implementing the Sustainable Development Goals (SDGs) (jakartaglobe, 2020).

Identifiable description	**Implementation progress**
Positive judgements can be given when external doubts about APP and APRIL (2, 3.3.2.3, case description) are reduced or disappear	Ongoing

3. ***Inconsistency between the initiative and implementation of individual enterprise***

To address environmental concerns, Asia Pulp and Paper Ltd (APP) issued a forest conservation policy to restore one million hectares of Indonesian rainforest (Covington, 2014).In 2005, APP engaged in a five-year partnership with the Rainforest Alliance, four concessions organised by APP dedicated to monitoring forest conservation values. However, this partnership was terminated in 2007 as the forest deteriorated and the company was criticised for not describing a coherent and complete approach to forest conservation management (RAPS, 2007). In addition, a survey revealed that APP's infrastructure development was generating large amounts of carbon and also threatening local biodiversity (e.g. Sumatran tigers) (Mongabay, 2020).

Identifiable description	**Implementation progress**
This partnership ended in 2007 with the deterioration of the forest, and the company was criticised for not describing a coherent and complete approach to forest conservation management. A survey showed that the construction of APP's infrastructure was generating large amounts of carbon and also threatening local biodiversity.	Negative

4. Discussion

The role of this chapter is to provide interpretation and discussion based on the comparative case studies, the results of which generate conclusions and recommendations for circularity/innovation implementation in Indonesia and European countries. Meanwhile, a general overview of the detailed comparative analysis of European countries and Indonesia containing implementation progress, factual descriptions and distinctive characteristics can be found in Appendix 1 (Comparison of European countries and Indonesia). In addition, the brackets containing information and numbers that appear in the discussion are references to other chapters (mainly Case description).

This chapter aims to answer the following research questions:

What distinctive characteristics can be identified behind the implementation of circularity/innovation in European countries and Indonesia, what case comparisons can be established between European countries and Indonesia, and what recommendations can be drawn to facilitate the implementation of circularity/innovation in European countries and Indonesia?

4.1 Biogas technology

4.1.1 State

In Indonesia, policies in the energy sector are inconsistent and even contradictory in different directions (3, 3.1.2.1, case description). The inconsistency between coal mining and the implementation of renewable energy technologies is a typical example. A weak sense of accountability in issuing policies can be seen in this issue. In Finland, however, the state is responsible for innovation, not only in the determined direction of implementing renewable energy systems, but also in the specific treatment of biogas technology. For example, the government has managed to find a way to combine the existing transport fuel policy with the biofuel policy in order to increasingly implement the use of biofuels (4, 3.1.1.1, case description). A number of individual companies and customers have proved to be involved in the supply and use of biofuels. Indonesia can look at the Finnish experience, which includes a firm direction for the implementation of a renewable energy system and a specific treatment for the release of environmental innovation technologies.

Several distinctive characteristics can be reflected in Finnish policy, such as accountability in issuing innovation policies, equal opportunities for stakeholders, impartial judgement in stakeholder actions, and transparent innovation regulations. The policy of support for biogas plants for electricity generation (1, 3.1.1.1, case

description) and adequate and reasonable investment subsidies for biogas plants (3, 3.1.1.1, case description) are typical examples of these distinctive characteristics in Finland. These experiences have the potential to be applied in Indonesia. With regard to the issue of regulatory uncertainty between the public and private sectors (4, 3.1.2.1, case description), it may be advantageous to guarantee equal access and transparent regulation between the public and private sectors. For the implementation progress of the biogas plant objectives and policies (2, 3.1.2.1, case description), as well as national projects of biogas technology in the agriculture and forestry sectors (1, 3.1.2.1, case description) that we have evaluated as 'ongoing' in Indonesia, creating equal opportunities for each stakeholder and making reasonable judgements about stakeholder actions may be helpful.

In Finland, the policy on biogas technology is constantly adapted to meet the expected performance in practice (2, 3.1.1.1, case description). However, positive results regarding the implementation of biogas technology from this experience have not been established. To improve the situation in Finland, the Indonesian state-supported project to communicate with farmers to disseminate biogas facilities (5, 3.1.2.1, case description) could be useful. In communicating with farmers to disseminate biogas facilities, the Indonesian government has established an extensive system of multi-stakeholders including farmer groups and forestry agencies. This extensive system aimed at disseminating biogas technology to farmers to reach their acceptance of the related products and resulted in a large number of farmers being found to have a positive attitude towards biogas facilities. State intervention was effective in this case and a similar extensive system of multi-stakeholders from the state and civil society could be established in Finland, which might be beneficial in addressing the inconsistency between published policies and actual performance.

4.1.2 Civil society

With regard to the inconsistencies applied between multiple sectors in Finland, multiple stakeholders from different sectors apply different standards for biogas digestate, which hinders the circularity of biogas waste (4, 3.1.1.2, case description). To deal with this impasse, stakeholders outside the Finnish sector could play a relevant role. The project BIRU, which contains new initiatives and is implemented by several international actors in Indonesia (1, 3.1.2.2, case description), could provide an applicable example for Finland. In this way, in Finland, NGOs could address the issue by initiating and planning negotiations between multiple sectors. Furthermore, NGOs could organise open cooperation with local stakeholders in Finland to address the issue of biogas waste standards, following the example of NGO coordination with local stakeholders in Indonesia. In particular, mutual adaptation and trust between NGOs and local stakeholders is essential (highlighted in the project BIRU). Therefore, the recommendation for Finland is to introduce professional and cooperative NGOs to deal with this issue.

In Indonesia, the market approach adopted by the BIRU project has achieved some degree of success in implementing biogas technology by triggering multi-stakeholder participation (2, 3.1.2.2, case description). Interdisciplinary expertise and open collaboration between multiple stakeholders are emphasised in a platform established by NGOs with a high degree of planning and innovation. Furthermore, a dynamic interaction is illustrated in the Indonesian market approach through mutual adaptation and competition and cooperation between competitors. This experience of the BIRU project in Indonesia could be replicated in Finland. It has been observed that in Finland there is an unbalanced form of implementation between the dominant and non-dominant sectors (5, 3.1.1.2, case description), which indicates an uneven implementation of biogas technology in different sectors. Although this phenomenon cannot be identified as positive or negative implementation progress for biogas technology, with reference to Indonesia, the dynamic interaction (market approach) between multiple stakeholders may contribute to the adoption of open cooperation and mutual adaptation between dominant and non-dominant sectors. At the same time, a high level of planning and innovation in the non-dominant sectors may be beneficial in initiating communication or negotiations between different sectors in Finland. Actually, in this regard, negotiations do take place between multiple stakeholders in order to reach commercial agreements (5, 3.1.1.2, case description), thus resulting in open cooperation in the distribution of electricity from biogas plants in Finland. Furthermore, competition and cooperation as well as mutual adaptation between multiple stakeholders are reflected in this Finnish factual description. Meanwhile, this experience could be applied in turn to Indonesia to address the regulatory uncertainty between the public and private sectors (4, 3.1.2.1, case description). In this way, through a high degree of planning and innovation, negotiation and mutual adaptation, as well as competition and cooperation among Indonesian multi-stakeholders, some form of balance between the public and private sectors might be established.

A great example of circularity/innovation is the cooperative biogas plant in Finland (3, 3.1.1.2, case description). The main actors are multiple farms (farmers) who together play different roles to process digestate from the digesters in order to recycle. A high level of planning and innovation, openness and competition and cooperation between multiple farms are outstanding reasons for this spontaneous and promising innovation/circulation in Finland. In order to promote and sustain cooperative biogas plants, not only open cooperation but also mutual trust and adaptation are required, as reflected in the factual descriptions. Furthermore, in the effective implementation of this circularity/innovation, the complementary relationship between multiple farms is demonstrated, a distinctive characteristic feature that can be seen as a key factor in achieving circularity. This Finnish experience may have potential for application in Indonesia. It has been observed that many farmers in Indonesia have adopted biogas digestate facilities and so far have started to use them on their own with the implementation of NGOs and the involvement of Indonesian government agencies (4,

3.1.2.2; 5, 3.1.2.1, case description). This way, the next step could be to move into the cooperative use of biogas digestate facilities between multiple farmers in Indonesia, taking into account the experience and characteristics of Finnish cooperative biogas plants.

Besides, it has been observed that the biofuel supply chain in Finland is expanding due to the construction of farm-scale refuelling stations and the use of biofuel vehicles (2, 3.1.1.2, case description). The openness of consumers in accepting biofuel vehicles is illustrated, as well as the high level of initiative, planning and innovation of farmers in establishing biofuel refuelling stations. In addition, the great power of initiative and implementation at the bottom level has been demonstrated in Finland, which has effectively driven the implementation of biogas technology.

The effective dissemination and user acceptance of biogas digester technology (4, 3.1.2.2, case description) can be seen as an important factual description of Indonesia due to the strong promotion of the Biogas Technology Project (BIRU). Market development and user diffusion are central to the planning and innovation of this project. There are three stages of analysis in achieving this effective circulation/innovation diffusion. Firstly, the professional attitude of individual companies and relevant stakeholders in communicating the benefits of biotechnology products to customers is reflected in the diffusion process. This process is not easy, as the dissemination of biotechnology products to farmers requires knowledge of the actual characteristics of the biodegradation facility and the specific background of the target farmers. Dealing with the acceptance of biotechnology products by farmers is a central issue. Secondly, an open and cooperative attitude of the customers towards the product can facilitate communication with individual enterprises/relevant stakeholders. Thirdly, open cooperation and trust between the individual enterprises/relevant stakeholders and the customers is developed based on the acceptance and use of biotechnology products by the customers. In this Indonesian case, the Finnish experience of multiple farms cooperating in the construction of biogas plants and the construction of farm-scale biofuel refuelling stations (2, 3.1.1.2, case description) may be of great help. These implementation projects in Finland were initiated and planned by farmers who recognised the potential benefits of biogas technology. Thus, the circularity of biogas technology has the potential to be widespread in Indonesia, from single farmers to multiple farmers. In this way, new forms of cooperation between farmers and further progress in the implementation of biogas technology can be expected to emerge in Indonesia.

In the following, the analysis is limited to the Finnish experience. In Finland, active communication between civil society and policy makers and between multiple sectors regarding the implementation of biogas technology has facilitated progress in the implementation of bioenergy projects (1, 3.1.1.2, case description). This Finnish experience mirrors the openness of multiple sectors/policymakers and the open

cooperation, mutual trust and adaptation between multiple sectors/multiple stakeholders, as well as the plurality of innovative ideas.

The following analysis is limited to the Indonesian experience. Positive biogas technology implementation progress has been achieved in Indonesia by training and educating individual enterprises in the BIRU project to facilitate the diffusion of innovations (3, 3.1.2.2, case description). NGOs and individual enterprises are the main players in training and education activities for the dissemination of biogas technologies. From the NGO side, NGOs applied a high degree of initiative and planning as well as a professional attitude in the implementation of biogas technology. At the same time, from the side of the individual enterprises, an open and cooperative attitude was demonstrated, resulting in a number of them being professionally trained in the implementation of biogas technology. All in all, an open partnership has been formed between NGOs and individual enterprises, resulting in the effective dissemination of biogas technology.

4.1.3 Individual enterprise

The market approach adopted by the BIRU project triggered multi-stakeholder involvement (2, 3.1.2.2, case description) and may help to address inconsistencies in the implementation of Finnish innovations by the state and individual enterprises (4, 3.1.1.3, case description), the latter of which demonstrates the barriers to biogas technology implementation encountered by individual enterprises in Finland when following relative policies. A high level of initiative, planning and innovation may be key to resolving the inconsistency between government policy and enterprise implementation in Finland. In the BIRU project, the Indonesian market development and user promotion strategy was initiated and planned by NGOs to effectively address local awareness of biogas technology. Such strategic innovations developed to address a local problem (lack of market for biogas technology) could be used as a reference for individual enterprises in Finland to break down barriers to biogas technology implementation.

On the difficulties faced by some customers (e.g. farmers) in Indonesia in installing, using and maintaining biogas facilities (2, 3.1.2.3, case description), reference can be made to the establishment of on-farm biogas refuelling stations in Finland (3, 3.1.1.3; 2, 3.1.1.2, case description). The Finnish experience highlights the high level of initiative, planning and innovation by customers/farmers. At the same time, affordable equipment and a convenient biogas supply chain network facilitate the establishment of on-farm biogas refuelling stations. This is a typical example of a transition from a customer using a biogas facility to a producer producing biofuels. To facilitate this transition, open collaboration between farmers and stakeholders in the biofuel supply chain and a market approach are key. This strategic transition could be applied in the future in Indonesia, where the current challenge is the lack of a business environment for the biofuel supply chain. To address the current challenges, large biogas technology

companies can play an important role in establishing the Indonesian biofuel supply chain network and its business environment, thus facilitating the involvement of new stakeholders, corresponding to the role of Gasum Ltd. in implementing biogas technology in Finland (2, 3.1.1.3, case description).

In response to the Finnish government's policy, a number of individual enterprises have been active in the implementation of biogas technology (1, 3.1.1.3, case description). The high degree of initiative and planning by individual enterprises in the field of biogas technology is underlined, and efficient and effective coordination between the government and individual enterprises in the implementation of biogas technology is implied. In contrast, highly proactive enterprise response to policy implementation was absent (except for NGO support) following/concurrent with the release of the Indonesian government's biogas technology implementation policy. This is a direct indication of the lack of initiative and planning by individual enterprises in the area of biogas technology to respond to the Indonesian government's policy. Furthermore, state intervention may also discourage the participation of individual enterprises through excessive control over national projects and an unclear vision of biogas technology development in Indonesia. Therefore, there is room for improvement for both the state and individual enterprises in achieving circularity/innovation in biogas technology in Indonesia.

The following analysis is limited to the experience of Indonesia. The market approach of the Biogas Technology Project (BIRU) has led to a series of achievements to a certain extent in Indonesia, supported primarily by interdisciplinary partnerships for innovative implementation (1, 3.1.2.3, case description). Behind the interdisciplinary partnerships for the implementation of biogas technology, several distinctive characteristics can be analysed. Firstly, the professional attitudes and competencies of the participants in the interdisciplinary partnership were highlighted to support the project. Secondly, a cooperative attitude and mutual trust between multiple actors was important in terms of internal coordination and team building of the partnership. Thirdly, the instrumental working relationship between multiple actors is reflected in efficient and effective working methods. In addition, the plurality of members and opinions is manifested in different specialisms and different work contents.

4.2 Circularity of plastics

4.2.1 State

In Germany, national regulations are synchronised with EU requirements (2, 3.2.1.1, case description), reflecting the rule of law and policy implementation between EU requirements and German innovation objectives. This German experience has the potential to be directly applied to the shortcomings of policy enforcement in waste management in Indonesia (4, 3.2.2.1, case description). In this way, the rule of law and

policy enforcement in waste management, as well as the right behaviour, needs to be implemented to the citizens of Indonesia. Furthermore, for the Indonesian government's waste data monitoring programmes (3, 3.2.2.1, case description) and the projects organised by the Indonesian government for national and international cooperation (5, 3.2.2.1, case description), the German experience of simultaneous coordination between EU requirements and national targets could be drawn upon to facilitate progress in their implementation. This would allow for the establishment of an authoritative system of waste management requirements in Indonesia that could be used to impartially assess progress in the implementation of waste management projects. At the same time, a cooperative attitude on the part of the government in assessing national and international cooperation projects is essential. These strategies could be useful at the state level in Indonesia.

The implementation of German regulatory transparency and legislation for the plastic packaging supply chain (3, 3.2.1.1, case description) demonstrates a strong rule of law, powerful state institutions and a corporative attitude (including give and take) of stakeholders involved in innovation. Decentralisation of regulations and policies on waste management to Indonesian city governments and citizens (1, 3.2.2.1, case description) may be beneficial in improving the ongoing progress in implementing regulatory transparency and legislation in the German plastic packaging supply chain (3, 3.2.1.1, case description). The Indonesian government has delegated autonomy to issue waste management policies to city governments, who have a high degree of initiative and planning in waste management implementation and are responsible for setting waste disposal fees for citizens. In fact, this decentralisation strategy has been applied to the relevant stakeholders in the German packaging supply chain, who have been given the power and responsibility to manage and use packaging waste. In this way, stakeholders in the packaging supply chain can take control of decisions regarding packaging waste and their initiative, planning and innovation are increased. In Germany, for example, consumers are at the forefront of waste separation, while waste collection is the responsibility of the municipalities. On this basis, however, national policies may need to be developed to deal with reusable packaging waste, such as how to properly manage returnable bottles.

In Germany, sector- and firm-specific innovation support policies play an effective role (4, 3.2.1.1, case description). Accountability for innovation and a professional approach to innovation are evident in the state's interventions. Furthermore, strong R&D for circularity/innovation in the plastics industry can be seen in the policies issued by the government. In contrast, the Indonesian government has initiated and supported several national projects on plastic waste management (2, 3.2.2.1, case description). Even though a responsible and professional attitude towards innovation is reflected in the state interventions, the progress in implementation cannot be described as positive. Excessive state intervention and insufficient R&D in policy issuance may have been factors that hindered progress in implementation. Referring

to the German experience, the government focused on developing and rolling out regulations and policies, leaving room for initiation and implementation to civil society and individual enterprises, while policy releases were rigorous in research and development of innovations in specific areas. These experiences could be used as a reference for Indonesia to implement circularity/innovation more effectively in the plastics industry.

In addition, it has been noted that in Germany the generation of regulations is carried out with high efficiency and involves multiple stakeholders (1, 3.2.1.1, case description). This fact is not directly linked to the implementation of circularity/innovation, but can be considered as a strong driving force in the process of circularity/innovation implementation. Accountable state institutions and transparency in publishing innovation policies are mirrored in this factual description. By contrast, the Indonesian government tends to approach circularity/innovation through a mix of policies, initiatives and implementation in which civil society stakeholders and individual businesses are subsequently involved. The German government, on the other hand, focuses only on issuing regulations and policies, leaving the space for initiatives and implementation to civil society stakeholders and individual enterprises. In particular, the increasing efficiency and effectiveness of the process of issuing innovation regulations and policies is seen as a highly beneficial factor in the implementation of circularity/innovation in Germany. The Indonesian government could learn from this German approach of focusing on the development policy making process.

4.2.2 Civil society

With regard to people's waste disposal behaviour in Indonesia that violates circularity (1, 3.2.2.2, case description), the German experience of product design triggering systemic change (3, 3.2.1.2, case description) may be helpful. Product design has a great potential to stimulate a shift towards circularity in people's lifestyles, business models and product supply chains by reusing the materials and energy used to produce products. This way, circular product design can be applied to products in Indonesia to change people's improper disposal behaviour. In order to achieve this goal, there is a need for a professional design agency to plan and innovate highly on circular product services at the production and consumption stages, and to engage with the plastics industry in Indonesia. Open collaboration between multiple stakeholders in the product supply chain is key. At the same time, complementary relationships and mutual trust between multiple stakeholders in the product supply chain are important to sustain the implementation of circular products. End-customers such as citizens are attracted to the design capabilities of the product (service) and accept the circular product, thus transforming their behaviour in using the product into a circular one. Thus, the problem of less civil society and the lack of cooperative attitude of citizens towards waste management could be improved in Indonesia. At the same time, design can have a positive effect in Indonesia at both the production and consumption stages.

In fact, in some pilots in Indonesia, the transition from sustainability to circularity has occurred in individual companies based on commercial considerations (1, 3.2.2.3, Case description). A key supporting factor in this factual description is the mutual adaptation between individual companies and their customers. Working with circular products requires a change in both the company's strategy in terms of design and the customer's behaviour in terms of use. This experience could be advantageous in addressing the difficulties that German consumers have in dealing with disposing of plastic packaging (6, 3.2.1.2, case description). Companies can plan and innovate to redesign plastic packaging products to be circular (reusable, returnable, etc.), thus shifting consumer behaviour towards circularity. In addition, the emerging shift from sustainability to circularity in some pilots in Indonesia (1, 3.2.2.3, Case description) could be beneficial from a business perspective in promoting a shift towards circular businesses. Although the degree of circularity in Germany is not the same as in Indonesia (where the former is more advanced), the transition from sustainability to circularity in the establishment of pilot projects in Indonesia has been quite rapid. This experience may, for example, help Germany to be inspired to address inappropriate waste handling by individual enterprises (4, 3.2.1.3, Case description) and to enhance the progress of incentives for individual enterprises to implement circular business (3, 3.2.1.3, Case description) through a comprehensive analysis of circular business models, such as an analysis of the application of Extended Producer Responsibility (EPR) in the short and long term.

The German project NABU of extensive implementation across different industries (4, 3.2.1.2, Case description) may have the potential to be applied in Indonesia. This German project describes the cross-sectoral cooperation that took place between the tourism and food packaging industries on a tourist island to address marine plastic waste. It can be argued that the characteristics of the background environment of tourist islands and the urgency of solving the problem of marine plastic waste facilitated this cross-sectoral cooperation. This particular approach could be used as a model for tourist islands in Indonesia. It is undeniable that the issue of marine plastic litter is prominent in Indonesia and this has the potential to promote cross-sectoral collaboration between the Indonesian tourist islands and the food packaging industry to address this issue. On this basis, the decentralised Indonesian islands and regions could work together to tackle the problem of marine plastic litter, where open cooperation and mutual adaptation between decentralised waste management implementations is essential, with reference to the German project of cross-sectoral cooperation (4, 3.2.1.2, Case description).

Third-party services for individual enterprises, such as consultancy, play an important role in circular innovation in Germany. Strategic support has helped a number of individual enterprises to realise circular innovation. The German district authorities have contributed to the creation of a platform for advisory services for individual enterprises (Schön wie wir), in which many enterprises are involved and some of which

have achieved scale in their circular business (1, 3.2.1.2, Case description). The mutual trust between the individual enterprises and the district authorities, the high level of initiative and the cooperative attitude of the enterprises are the main characteristics of the platform. At the same time, the equal treatment of individual enterprises is highlighted in this established platform. These distinctive characteristics of the German experience may help to advance the observed research activities on the problem of plastic waste in Indonesia (8, 3.2.2.2, Case description). Accordingly, the local government in Indonesia will establish a research platform in which mutual trust between research stakeholders and the local government, a high level of initiative and cooperative attitude of the research stakeholders and equal treatment of the research stakeholders will be the distinctive characteristics. This way, the Indonesian research platform will achieve promising research results in addressing plastic waste.

A specific consumer behaviour change programme has been observed in Germany (2, 3.2.1.2, case description) and progress is being made in its implementation. To facilitate the implementation of the programme, it may be useful to refer to the demonstration case Green Indonesia (4, 3.2.2.2, case description) for waste cycling (recycling) education in primary and secondary schools in Indonesia. Multiple stakeholders are involved, including teachers, students, local government, research institutions, school leaders, plastic producers and students' families, in order to implement primary and secondary school circularity education. Several steps can be shaped to describe (analyze) the implementation process. Firstly, openness and collaboration between local governments, research institutions, plastics producers and school leaders helps to produce well-planned and innovative teaching materials. Secondly, the training of school teachers in the requirements for teaching waste circularity led to the creation of a professional school teaching force. Thirdly, mutual trust and adaptation between multiple stakeholders, especially between teachers and students (and their families), is underlined for effective teaching and learning. Fourthly, educated students are expected to become the knowledge bearers of the future and have a positive impact on future circular development. In the meantime, the transparent operation and high credibility of primary and secondary schools are important factors in supporting effective teaching and learning. Green Indonesia has successfully enabled primary and secondary schools to act as waste collection points for the community, while working with local authorities to upgrade waste collection systems and install waste bins. The project is being expanded to more schools. It is thus suggested that primary and secondary education on waste circularity could be applied in Germany to trigger behavioural change towards circularity. In addition, this circular approach to teaching (4, 3.2.2.2, case description) positively influences the surrounding environment through the circular products distributed to students (spread from school teaching to students' families and communities) and may be beneficial for application in German communities to change people's behaviour towards accepting circular products.

The fact that a reusable packaging transport project (5, 3.2.1.2, case description) based on the cooperation of individual company and research institutes in daily innovation has emerged in Germany shows the professionalism of this cooperation project and the open cooperation and mutual trust between individual company and research institutes. The reference to the specific cooperation project for the technological upgrading of waste management implemented by the local government in Indonesia with individual companies (3, 3.2.2.3, case description) may advance the implementation progress of this German cooperation project. In this way, the German local government could play a relevant role in supporting the cooperation project by implementing incentives and subsidies for companies and research institutes working on circular innovation projects. This would increase the initiative and planning of enterprises and research institutes and increase the number of participating enterprises and research institutes, especially start-ups, which might accelerate the realisation of circularity/innovation in the German cooperation project.

In Indonesia, three factual descriptions of cooperation with international stakeholders and the specific projects included therein show positive implementation progress of circularity/innovation. They are: the establishment and widespread implementation of a waste bank in cooperation with the city of Medan (3, 3.2.2.2, case description), the cooperation between international stakeholders and local authorities leading to a reduction in marine plastic waste (STOP project) (5, 3.2.2.2, case description), and the organisation of community activities to address the circularity of plastics (STOP project and other projects) (7, 3.2. 2.2, case description). Both the first and second factual descriptions highlight the open cooperation between international stakeholders (Japanese stakeholders in the establishment of the waste bank; SYSTEMIQ, Borealis and the Norwegian government in the STOP project) and local authorities. In particular, the establishment and implementation of the waste bank in Medan and the extended implementation of waste banks in other cities in Indonesia, and the positive impact of the waste bank project on other projects, such as the green education in Indonesia (4, 3.2.2.2, case description), in which the 'school waste bank' drew on the waste bank being established as a waste collection point for schools and communities. The third experience reflects mutual trust and adaptation between international stakeholders and citizens. Specifically, the second and third experiences are organised in a project called STOP, which aims to reduce marine plastic waste in Indonesia. The comprehensive planning and responsible implementation of this project has contributed to some of the achievements in Indonesia in terms of circularity/innovation, such as reducing marine litter and increasing employment opportunities.

It is undeniable that international stakeholder involvement has contributed to some extent to circularity/innovation in Indonesia in some specific projects from the two case studies of biogas technology and the plastics industry. The professional attitude of the NGOs, the open and cooperative attitude of the local government and citizens,

the high level of initiative and planning of the NGOs and local government, the professional team building of the NGOs and local government, the plurality of innovative opinions and the open labour market were key to these implementations. But on the other hand, we can note that the observed effective initiatives and programmes at the bottom level in Indonesia are mainly from with international stakeholders, which means that the level of local initiatives and programmes in Indonesia is limited. So raising the level of local initiatives and programmes in Indonesia is also important for circularity/innovation.

4.2.3 Individual enterprise

The closed-loop PVC supply chain of the Rehau AG project in Germany (1, 3.2.1.3, case description) is a case study of an innovation that has been successful in environmental and commercial terms. A large number of distinctive characteristics can be found in this project: the high level of initiative, planning and business model innovation of the rehau organisation, the open cooperation between the multiple stakeholders in the PVC supply chain (profile manufacturers and window manufacturers, PVC recyclers, window installers and end customers), the mutual adaptation of the multiple stakeholders in problem solving (e.g. from technical issues in the application of PVC recyclates to the development of innovative recycling technologies), and complementary relationships between multiple stakeholders to facilitate a closed-loop PVC supply chain. Furthermore, both competition and cooperation between recycling competitors in this context facilitate mutual adaptation between multiple stakeholders to achieve technological innovation (i.e. advanced sorting technologies.) Mutual trust between multiple stakeholders in the PVC supply chain also supports effective implementation in both environmental and commercial terms. This project from Germany (1, 3.2.1.3, case description) can be applied to address the issue of household waste services in Indonesian cities (2, 3.2.2.3, case description). In Indonesia, a lack of planning and innovation as well as a professional attitude in the informal sector can be observed, which can be referred to the experience of Rehau, which has played a central advisory role in developing a business model strategy. Accordingly, the informal sector in Indonesia could establish a consultancy unit or work with a professional consultancy to provide support for innovation in business models. Moreover, the lack of citizen support for waste disposal services is a prominent problem in Indonesia (2, 3.2.2.3, case description). Referring to the German project of Rehau AG, building a cooperative attitude and trust between the informal waste sector and citizens is necessary for this issue.

The fact that consultancy plays an important role in supporting individual businesses in Germany (2, 3.2.1.3, case description) illustrates the planning and innovation of individual businesses as well as the professional attitude and high credibility of consultancy services. It also demonstrates the open cooperation and mutual trust between individual enterprises and advisory services. Referring to the German experience, advisory services might be applied to improve the progress of

implementation in Indonesia in the following case: the perception of some individual companies and customers regarding the safety of reused plastics (2, 3.2.2.2, case description). Food safety issues with reused plastic packaging are mainly caused by uncertain perceptions between some companies and customers. In order to solve this problem, mutual trust, openness and cooperation need to be established between companies and their clients. Meanwhile, with reference to the consultancy services working in Germany (2, 3.2.1.3, case description), these Indonesian companies can establish a professional attitude and a high level of credibility through the assessment and certification of reused plastic packaging with third-party organisations or independently published on food safety issues. In this way, a circular optimisation strategy and implementation between some individual companies and their customers could be achieved, which may also break the uncertain perceptions of customers.

In Indonesia, the issues surrounding informal waste workers (6, 3.2.2.2, case description) reflect the open labour market and the reduced level of initiative within and between the informal waste sectors. To address the reduced level of initiative, the German experience of third party services (2, 3.2.1.3, case description) could be drawn upon, so that planning and innovation in the informal waste sector is increased with the support of third party services (e.g. consultancy services). In addition, upgraded waste treatment technologies could be implemented in the informal waste sector in Indonesia in order to generate more value from waste and thus improve the informal waste working environment. In Indonesia, the good news is that a number of projects are engaged in improving the job satisfaction of waste operation workers, which illustrates the positive development of circularity/innovation (4, 3.2.2.3, case description). Also, equal treatment and team building of waste operation workers and professional training (3, 3.2.2.3, case description) are highlighted in individual projects in Indonesia. At the same time, planning and innovation in individual enterprises, mutual trust and adaptation between individual enterprises and waste operation workers were also emphasised. Furthermore, relevant policies have been introduced in Indonesia to improve the job satisfaction of waste operation workers.

4.3 Innovations in the pulp and paper industry

4.3.1 State

In Sweden, state intervention in the innovation of individual firms (2, 3.3.1.1, case description) has proved to be effective in helping firms to meet the requirements of innovation. The responsibility of the state to intervene in innovation, the cooperative attitude, the mutual trust and adaptation between the state and individual enterprises are all illustrated in this fact. In Indonesia, the government has issued some strict

policies in the area of land and environmental management (1, 3.3.2.1, case description), which reflects accountability in policy issuance. Ideally, this Swedish experience (2, 3.3.1.1, case description) could be used to stimulate progress in implementing stringent land environmental management regulations in the pulp and paper industry in Indonesia. Drawing on the Swedish experience can build mutual trust, a cooperative attitude and adaptability between the state and individual companies to help Indonesian companies meet the regulations that have been issued. Furthermore, drawing on the Swedish experience (2, 3.3.1.1, case description), state intervention to keep an eye on the implementation of corporate policies would be beneficial in addressing this situation in Indonesia.

However, the violations and the lack of clarity in the government's response regarding individual enterprises in Indonesia (3, 3.3.2.1, case description) are a direct reflection of several issues, including the lack of credibility of individual enterprises and the poor enforcement of policies. Furthermore, the transparency and impartiality between the state and individual enterprises is negatively exposed. Meanwhile, this fact also makes it possible to start reconsidering another description (discussed) of Indonesia's issuance of strict land environmental regulations for the pulp and paper industry (1, 3.3.2.1, case description). Firstly, the rule of law, accountability and policy enforcement are all negatively represented. Secondly, the strong inconsistency between the policies issued and the actual implementation by companies led to doubts about the relationship between the government and individual companies (e.g. whether there was a relationship of personalisation and particularisation). To address this problematic situation, the Swedish experience of state intervention in individual firm innovation (2, 3.3.1.1, case description) can be repurposed to its advantage. In Sweden, the government has not only issued relevant innovation policies, but has also been involved in the innovation of individual firms by issuing clear requirements and adequate innovation subsidies. At the same time, the mutual trust and adaptation between the state and individual enterprises is highlighted by issuing a generous adaptation period for the enterprises in the process of promoting innovation. This responsible and adaptive intervention from the state may be applicable to the problems between the state and individual enterprises in Indonesia. On this basis, it could be suggested that an independent evaluation phase from international stakeholders targeting circularity/innovation development be added between government policy and enterprise implementation in Indonesia. Nevertheless, the use of the above recommendations presupposes that transparency, equity and policy enforcement in Indonesia are improved, as it is useless to address the issue if it is not perceived as a problem by those involved.

Moreover, Sweden's experience in implementing a range of environmental regulations for the pulp and paper industry (1, 3.3.1.1, case description) may help to improve progress in the implementation of environmental management regulations issued for land in Indonesia (1, 3.3.2.1, case description). In Sweden, solving environmental

problems in the pulp and paper industry is a central objective of regulations and policies. In this regard, the Swedish government has demonstrated accountability in addressing environmental issues by continuously adapting its policies to address specific environmental issues. Based on the Swedish experience, the Indonesian government could divide the environmental management of land into multiple specific (environmental) issues, thus making them easier to address.

It is undeniable that the ecosystem restoration permits issued by the Indonesian government (2, 3.3.2.1, case description) have been effective in providing incentives for individual companies to meet regulatory requirements, although only if there is increased transparency and fairness between the government and individual companies. This experience in Indonesia demonstrates the accountability of policy issuance and the high level of initiative of individual enterprises. The existing sludge reuse regulations in Sweden (3, 3.3.1.1, case description) illustrate the accountability of the state in issuing circular policies. Comparing the former (Indonesian) with the latter experience (Swedish) highlights the role played by individual enterprises. With reference to the Indonesian experience, the existing sludge reuse regulations could be adapted to target individual enterprises. Reference could be made to the form of corporate sludge reuse permits, which could be linked to relevant incentives to stimulate enterprises to obtain permits. In this way, sludge reuse regulations and policies would be increasingly promoted and applied to achieve circular implementation in the Swedish pulp and paper industry.

4.3.2 Civil society

Finnish energy company Gasum and the Swedish paper mill (Nymölla) of Stora Enso, a Finnish-Swedish company, cooperate across borders to convert pulp and paper mill wastewater into energy (1, 3.3.1.2, case description). The high level of initiative, planning and innovation in decision making between Gasum and Stora Enso can be considered as the main driving force behind this innovation. At the same time, the open cooperation, mutual trust and adaptability between Stora Enso and Gasum are highlighted. Furthermore, the circular supply chain of pulp and paper industry wastewater was extended together with multiple stakeholders in the production, transport and consumption phases of liquefied biogas (LBG). Open cooperation between multiple stakeholders was demonstrated. This experience can be referred to the case of Indonesia, where the application of biogas digestate facilities has been successful according to the case study of biogas technology. Therefore, it is recommended that biogas technology stakeholders establish cooperation with the pulp and paper industry to reuse their by-products for biofuels. Nevertheless, regulations for by-products from the pulp and paper industry and attitudes towards cooperation between stakeholders need to be determined before such cooperation can be implemented in Indonesia.

Innovative research on the application of waste sludge from the pulp and paper industry has been taking place in Sweden (2, 3.3.1.2, case description). However, no similar research could be found in Indonesia, which indicates a lack of awareness of sludge reuse. In fact, existing proposals for circularity strategies for the Indonesian pulp and paper industry can be obtained from companies abroad (1, 3.3.2.2, case description). Experts from Asia Pulp and Paper (APP) in Canada have delineated a number of strategies that have been tailored to the Indonesian context. However, the actual implementation of these strategies in Indonesia has not been shown and these circular recommendations have not been confirmed to be utilised by any Indonesian pulp and paper industry stakeholder. Furthermore, the large paper company APP has designated manufacturing subsidiaries in Indonesia and strategies from APP Canada are considered to be potentially linked to APP Indonesia. From this point of view, it is suggested that an open cooperation and mutual trust could be established between APP Canada and APP Indonesia. In the meantime, this suggestion could be based on the Swedish experience of a research-based strategy of an individual company (Stora Enso) in the pulp and paper industry (4, 3.3.1.3, case description). The Swedish research-based strategy is not only useful for solving Stora Enso's specific problems, but also for building the company's image. In light of this experience, APP Indonesia could enhance its initiatives and planning for circularity, while embracing APP Canada's enabling strategies. In addition, with reference to the two Swedish experiences discussed above, it is important to allow for innovative opinion (strategy) pluralism in Indonesian companies in the pulp and paper industry, which will enable new innovative implementations.

In Sweden, there is not only research related to the reuse of by-products from the pulp and paper industry, but also cooperation between companies, support providers and research institutes for the circularity of by-products (3, 3.3.1.2, case description). These companies come from different industries such as the chemical industry and the mining industry. The circularity of by-products from the pulp and paper industry (fibre sludge and green liquor residues) is achieved between these industries with the support of research and consultancy providers. Some distinctive characteristics can be identified: a high degree of planning and innovation, the professional attitude of the multiple stakeholders (especially in terms of technical support for the transformation from by-products to new products), open collaboration (cooperative attitude), mutual trust and adaptation of the multiple stakeholders in the by-product loop, the complementary relationship between the multiple stakeholders (different stakeholders are responsible for different stages of the transformation of by-products into new products and therefore their specific work is complementary). In Indonesia, the implementation of existing circular strategies and individual enterprises (APP and APRIL) has been observed (3, 3.3.2.3, case description). By-products from the pulp and paper industry are reused as raw materials and renewable energy for internal production. At the same time, local government and third party service providers are involved in the circularity strategy and implementation in Indonesia. Comparing the

Swedish and Indonesian experiences, differences can be identified, namely the lack of professional attitudes and technical (research) support in the Indonesian case, as well as the mutual adaptation of multiple stakeholders.

Furthermore, the differences between the Swedish and Indonesian experiences may not only lie in the description of the facts, but also in their way of thinking. There might be a different mindset between Indonesian and Swedish companies, with Indonesian companies acting more introverted and seeking improvements for themselves, while Swedish companies acting more extroverted and looking for what other stakeholders can do with the products (or by-products) produced. This mentality hypothesis could also be applied to the comparison between the European countries studied (i.e. Finland, Germany, Sweden) and Indonesia. One explanation for this could be that technological development and research support, Indonesia being a developing country, their current level of technological development and R&D has led to a closed group mentality, whereas the advanced level of technological development and R&D in the European countries has promoted an open and cooperative mentality. Therefore, it could be suggested that the Indonesian national government should increase its investment in technology and scientific research.

4.3.3 Individual enterprise

In Sweden, some of the implementation efforts are centred around the goal of environmental protection. Two typical examples are the large investments in environmental innovation by pulp and paper producers (1, 3.3.1.3, case description) and the production of environmentally friendly paper products by local integrated paper mills (3, 3.3.1.3, case description). The common distinguishing characteristics of both experiences are the high degree of corporate initiative, planning and innovation, and the professional approach to environmental innovation with environmental R&D team building at its core. Specifically, it can be seen that significant investments in environmental innovation can directly influence the application of innovative technologies in Sweden, which indicates an advanced and stable development of technology and R&D levels. At the same time, environmentally friendly paper products are considered to be a special innovation geared towards circularity in Stora Enso's initiatives and programmes, where open cooperation and complementary relationships between stakeholders in the paper supply chain are highlighted. In Indonesia, APRIL Indonesia publishes initiatives and plans to address sustainable land management through the development of policies, environmental assessment methodologies, advisory committees and monitoring units (1, 3.3.2.3, case description). As a comparison, it can be observed that the main emphasis of Indonesia's innovations is on sustainability, while Sweden's innovations include sustainability and circularity. This hypothesis can also be derived from the differences in distinctive characteristics, where open cooperation and complementary relationships between multiple stakeholders (circularity characteristics) are prominent in the Swedish experience, but are not mirrored in the Indonesian

experience. In this respect, it can be argued that Indonesia is a developing country that is still striving for sustainable development as they have not yet reached the technological level to talk about circularity. On this basis, it could be suggested that individual companies in Indonesia develop an extrovert mentality (discussed in 4.3.2), which may help them to be more cooperative and move forward faster in terms of circularity, and in the process they may be able to address sustainability issues at an accelerated pace in this way.

The pulp and paper industry's transition to energy efficiency in response to the challenges of global competence and the electricity market has been successful in Sweden (2, 3.3.1.3, case description). The high degree of initiative, planning and innovation between global competitiveness, the electricity market and the pulp and paper industry is mirrored in this experience. It has not been an easy transition for Indonesia, where there are far more problems to be solved than in Sweden. For example, the lack of credibility of individual enterprises and the absence of a fair and transparent business environment are manifested in the inconsistency between the initiatives and implementation of individual enterprises in Indonesia (2, 3.3.2.3, case description). In this fact in Indonesia, without addressing the former, further problems such as the revealed lack of planning and innovation and poor cooperative attitudes cannot be addressed, as the former is considered to be a prerequisite for innovation. This argument can also be applied to other Indonesian experiences. Individual enterprises (APRIL) have established policies, environmental assessment methods, advisory committees and monitoring departments to address sustainable land management issues (1, 3.3.2.3, case description); individual enterprises (APP and APRIL) have existing recycling strategies and implementation (3, 3.3.2.3, case description). In these experiences, one can see the work of APRIL and APP on multiple strategies and implementation of circularity/innovation. However, some authoritative reports show that their violations of regulations have produced serious environmental pollution. This inconsistency between implementation and results has led to doubts about the credibility of companies, the transparency and impartiality of the business environment and the accountability of the Indonesian government. It is not difficult to argue that without addressing the above issues, it will be considerably hard to achieve circularity/innovation in Indonesia.

Furthermore, it could be argued that there is a new distinctive characteristic of Swedish innovation compared to the original distinctive characteristics of Systems I and II (Kroesen et al., 2020). Networked learning may be a distinctive characteristic of the Swedish environment. In the face of global competence and electricity price issues related to the pulp and paper industry, innovative transformation is constantly taking place in Sweden, where energy efficiency has been achieved and circular transformation is underway. In contrast to Germany, where simultaneous implementation between EU requirements and issued policies takes place, Sweden demonstrates the independent and rational development of innovation with state

support. Simultaneously, the development of innovation in Sweden is not closed, but rather stresses open cooperation, mutual trust and adaptation, as well as complementary relationships between multiple stakeholders (national and international). Coming back to the facts again, the transition to energy efficiency in the Swedish pulp and paper industry (2, 3.3.1.3, case description) reflects a high degree of initiative, planning and innovation in the pulp and paper industry in response to global competitiveness and the electricity market, in which the Swedish pulp and paper industry itself can be seen as an actor in continuous technological and R&D upgrading through interaction with the environment. In this way, a network learning process can be described behind the implementation of circularity/innovation in Sweden.

4.4 General discussion

4.4.1 Circularity/innovation implementation progress and social transformation

In terms of circularity/innovation implementation progress in general, it can first be found that the European countries studied contain more positive examples of circularity/innovation implementation progress than Indonesia, and that Indonesia contains more negative examples of circularity/innovation implementation progress than the European countries studied, which suggests that the European countries studied are better at circularity/innovation implementation than Indonesia's circularity/innovation implementation. Furthermore, it can be observed that the European countries studied contain more examples of ongoing circularity/innovation implementation progress than Indonesia, suggesting that the European countries studied are developing circularity/innovation at a greater rate than circularity/innovation in Indonesia. However, it cannot be denied that Indonesia contains some examples of positive circularity/innovation implementation and ongoing examples, while the European countries studied contain individual examples of negative circularity/innovation implementation. Taken together, they all contribute to the content of this study.

Linking circularity/innovation implementation progress to the distinctive characteristics already present in Systems I and II (Kroesen et al, 2020) reveals that the distinctive characteristics of positive circularity/innovation implementation progress in this study are similar to those of System II. The distinctive characteristics of negative implementation progress are associated with a certain lack of the distinctive characteristics of System II as well as some of the distinctive characteristics of System I. It can be concluded that the distinctive characteristics of System II are of key importance for the implementation of circularity/innovation, i.e. the implementation of circularity/innovation in this environment can be achieved as long as the environment in which it is located meets the distinctive characteristics of System II.

From a practical point of view, it can also be concluded that progress in the implementation of circularity/innovation is positively correlated with the degree of transition to System II.

Returning to the distinctive characteristics of System I and System II themselves, in terms of the environment in which circularity/innovation is achieved, it can be concluded that both the European countries studied and Indonesia are navigating in an in-between region between System I and System II. The European countries studied are sailing mainly towards System II, while not excluding individual directions towards System I. In Indonesia, there are two directions of navigation towards System I and System II, and the two forces behind the directions seem to be evenly matched. Combined with the previous inference that the progress in the implementation of circularity/innovation correlates with the degree of transition to System II, this can be further demonstrated to be consistent with the actual implementation of circularity/innovation in the European countries studied and in Indonesia.

4.4.2 Characteristics and interactions in multiple levels

The forces behind Europe and Indonesia navigating the in-between region of System I and System II are the same forces behind the implementation of circularity/innovation.

In the European countries studied, interactions can be observed between state policies with a high level of scientific and technological research and civil society and individual enterprises with a high level of initiative and planning, while the positive implementation of circularity/innovation corresponds to the interaction between the levels. This leads to the conclusion that in the European countries studied, the characteristics and interactions between the levels of the state, civil society and individual enterprises are reflected positively in the implementation of circularity/innovation. In Indonesia, interactions can be observed between unclear vision setting and over-intervention by the government, poor citizen behaviour, and lack of local initiatives and planning by enterprises, while negative implementation of circularity/innovation corresponds to the interaction between the levels. This leads to the conclusion that in Indonesia, the characteristics at each level of the state, civil society and individual enterprises and the interactions between levels are negatively reflected in the implementation of circularity/innovation.

Combining the European countries studied and Indonesia, it can be concluded that the characteristics and interactions between the levels of the state, civil society and individual enterprises are important for the implementation of circularity/innovation. When comparing the European countries studied with Indonesia, the former has a better implementation of circularity/innovation than the latter, as reflected in the characteristics and interactions between the levels of the state, civil society and individual enterprises. Furthermore, there is a relationship between the characteristics

at each level and the interactions between the levels. It can be concluded that there is a positive interaction between state policies with a high level of scientific and technological research and civil society and individual enterprises with a high level of initiative and planning, thus facilitating the implementation of circularity/innovation. Negative interactions between unclear vision setting and over-intervention by government, poor citizen behaviour and lack of local initiative and planning by enterprises hinder the implementation of circularity/innovation.

4.4.3 Behind the interactions on and between multiple levels

In essence, interaction is a mutual interaction between two parties.

This study shows that open cooperation, mutual trust and complementary relationships between stakeholders will contribute to better implementation of circularity/innovation, where the European countries studied perform better than Indonesia in this regard. At the same time, the development of circularity is more advanced in the European countries studied than in Indonesia. Together, these two situations suggest that not only is the development status of circularity/innovation already lagging behind in Indonesia, but the current pace of development is also slower, which means that Indonesia will face multiple challenges and difficulties in implementing circularity/innovation, a finding that is not an optimistic one. In order to improve the current state of circularity/innovation development in Indonesia, the question needs to be answered as to why there is a relative lack of open cooperation, mutual trust and complementary relationships between stakeholders in Indonesia compared to the European countries under study.

To answer this question, it is useful to apply the observations of this study that in Indonesia, NGOs play a more important role in the implementation of circularity/innovation in terms of communication with local stakeholders or dissemination to other stakeholders (4.1.2, discussion), whereas in the European countries studied, many stakeholders are already collaborating with each other in the bottom-level implementation of circularity/innovation (4.1.2, discussion). Since the former is still focused on the communication and dissemination of circularity/innovation while the latter has already entered into collaborative implementation, the implementation of the latter is naturally more advanced than the former. It is further revealed from this comparison that bottom-level implementation in Indonesia is relatively unidirectional (i.e. from NGOs to local stakeholders), whereas bottom-level implementation in the European countries studied is mutual (i.e. collaborative). In fact, judging from the certain degree of positive acceptance of circularity/innovation products by local stakeholders and customers in Indonesia (3.1.2.2, case description), it can be implied that people are not completely closed in the group and they do not completely lack awareness of circularity/innovation at the bottom. At the same time, combined with the observation of the relative lack of

initiative in Indonesian bottom localities (4.2.2, discussion), it can be argued that Indonesian bottom local stakeholders tend to have a dependency relationship with others when implementing circularity/innovation rather than a lack of awareness of circularity/innovation. This leads to the inference that if local stakeholders lose the support of current NGOs, it will be difficult for them to implement circularity/innovation sustainably and independently. In this case, too much state intervention might explain the dependency relationship at the bottom of Indonesia. In dependency relationships, interactions are unbalanced and control is exerted from one party to the other, in contrast to open cooperation, mutual trust and complementary relationships that are formed from a holistic perspective along a mutually beneficial equilibrium, the latter of which this study suggests is a pathway towards circularity/innovation (4.2.2, discussion). This argument leads to two ultimate corollaries. One is that the dependency between stakeholders at the bottom of Indonesia could explain the lack of relatively open cooperation, mutual trust and complementary relationships in Indonesia. The other is that holding a holistic perspective and ensuring mutual multi-stakeholder interest is important for state intervention in circularity/innovation implementation.

In general, two archetypes of social institutions can be identified in this study: vertical networks (i.e. closed internal groups, command and control, privilege, etc.) and mutual interaction (i.e. communication, negotiation, dialogue, etc.). These two social-institutional archetypes are used throughout the study. Specifically, these two social institutional archetypes are applied in this study to identify and analyse the implementation of circularity/innovation, and in turn, the results of the analysed circularity/innovation implementation progress reflect these two social institutional archetypes. It can be observed that the implementation of circularity/innovation in Indonesia is biased towards vertical networks, while the European countries studied are biased towards mutual interaction. Excessive vertical networking can lead to long-term stagnation in the implementation of circularity/innovation. Too much interaction may lead to excessive corporate individualism and liberal behaviour, which may weaken the function of the state. This makes it all the more important how mutual interactions in the social system take place, i.e. that they are not black and white but more or less so in the implementation of circularity/innovation.

4.4.4 Norms and ethics

Norms and ethics are implicated in and behind Kroesen et al.'s (2020) Social Transformation Model. Thus, this study has linked norms and ethics to some extent to the implementation of circularity/innovation. Firstly, this study has revealed the important role of norms and ethics in the implementation of circularity/innovation and even in some cases it is a precondition for the implementation of circularity/innovation (4.3.3, discussion). In addition, this study examines the importance of establishing norms and ethics in the context of social transformation, which need to be established in line with the trends of social transformation rather

than going against the grain (4.3.3, discussion). Furthermore, the establishment of norms and ethics in a multi-regional context is also important for the implementation of circularity/innovation, which needs to be linked to its regional characteristics, after all, different regions may have different potentials and routes for developing circularity/innovation. It follows that norms and ethics are not definitive but relative in the implementation of circularity/innovation (4.4.3, discussion). At a subliminal level, norms and ethics in accordance with the laws of nature can nourish social transformation and circularity/innovation.

4.4.5 Adjusted Social Transformation Model

In addition to the existing characteristics in System I and System II, some new characteristics have been added (marked in blue). They were identified as arising from the analysis of the cases in this study and they are considered important for achieving circularity/innovation. Specifically, the mutual trust and complementary relationships between stakeholders are reflected in the positive implementation of circularity/innovation in several cases (4.1.2; 4.2.2; 4.3.2, discussion). At the firm level, transparency and credibility of firm operations are important for the implementation of circularity/innovation, especially in some Indonesian firms, which have fared relatively poorly (4.3.3, discussion).

Table 2: Distinctive characteristics of System I and System II adapted from (Kroesen et al, 2020) (distinctive characteristics in blue were added in conjunction with this study).

	System I		System II	
	Institutions	Values	Institutions	Values
State	Patrimonialism at the top, granting favors and privileges in return for services	Obedience and loyalty, hierarchy, status personalized relationships, particularism	Rule of law, equal access, strong but accountable state institutions, property protection, contract enforcement	Universalism, Equal access, justice, transparency
Civil society	Closed in groups, vertical networks, little cooperation	Lifelong solidarity, adaptation to the group, traditionalism, uncertainty avoidance	Civil society, open cooperation at the bottom, changing coalitions (apart from family loyalty and state authority), complementary relations	Open attitude, mutual adaptation, multiple memberships, pluralism of opinions, mutual trust
Individual enterprises	Family based, distributed activities, dependent on position and opportunities in the vertical network	Command and control, status through position, closed in-group ethos, loyalty counts more than efficiency, synchronic time management, privileged treatment of in-group members	Open labor market, contracts, instrumental working relations, both of competition and cooperation between competitors, transparency of company operation	Individual judgement, professional attitude, initiative, status by achievement, planning and innovation, cooperative attitude, equal treatment, teambuilding, credibility

5. Conclusion and recommendation

This study examines the theme of circularity/innovation. It is a literature-based study. A multidimensional perspective, entailing the levels of the state, civil society and individual enterprises, is the main research approach of this study. Furthermore, the functioning and rules of Systems I and II (Kroesen et al, 2020) provide theoretical and conceptual support for the entire study. Regarding the environmental (geographical) setting of this study, two groups of countries (European countries and Indonesia) were identified to form a comparative case study. Three cases (biogas technology, circularity of plastics, innovations in the pulp and paper industry) were selected for this study, corresponding to the three selected European countries (Finland, Germany, Sweden). Three main steps were established to conduct this study. Firstly under each case, the selected European countries and Indonesia were subjected to their respective case descriptions and analyses. A comparative analysis and discussion of the selected European countries and Indonesia was then carried out under each case. Finally, corresponding conclusions and recommendations were drawn for the implementation of circularity/innovation in Indonesia and the selected European countries.

Please note that in the case description chapter, all the descriptions studied are summarised by title and number, which makes them easier to view and also serves as a conclusion of the case descriptions. In addition, a full correspondence between the factual descriptions and the distinctive characteristics behind the implementation of circularity/innovation can be seen in the comparison table between European countries and Indonesia in the appendix 1.

This chapter is divided into three sections, Conclusions, Recommendations, Limitations, implications and recommendations for further research, which are developed below. (Information and numbers in brackets, i.e. references to other chapters).

5.1 Conclusions

1. Towards circularity/innovation, a transition is taking place between System I and System II, with both the European countries and Indonesia in this study navigating through it. This study shows that the European countries' distinctive characteristics in terms of circularity/innovation are close to those of System II, independent of those of System I, while a large number of Indonesia's distinctive characteristics in terms of circularity/innovation lack to some extent those of System II, and in addition, some of Indonesia's distinctive characteristics are close to those of System I (4.4.1, discussion).
2. In the European countries studied and in Indonesia, circularity/innovation implementation progress was correlated with the degree of transition to System II. The distinctive characteristics of positive implementation progress were similar to those of System II. Negative implementation progress distinctive characteristics were associated with a certain lack of System II

distinctive characteristics and some System I distinctive characteristics (4.4.1, discussion).

3. In the European countries studied, bottom-up circularity/innovation initiatives have taken place to a large extent, while policies are constantly adapted to the actual implementation of circularity/innovation. In Indonesia, the state has played a leading role in issuing policies and initiating circularity/innovation projects, but the corresponding implementation of the projects has not yet met the targets (4.1.1; 4.1.3, discussion).
4. The advanced and consistent development of technology and R&D is highlighted in the studied European policy making and companies in the implementation of circularity/innovation, while this aspect is lacking in Indonesia (4.2.1, discussion).
5. In Indonesia, dubious relationships (e.g. personalisation and particularisation) between government and individual companies have been observed to negatively influence the implementation of circularity/innovation (4.3.1, discussion).
6. In the European countries studied and in Indonesia, open cooperation and complementary relationships between multiple stakeholders in the product supply chain, as well as the openness of customers to accept circular innovative products, are reflected in a more effective implementation of circularity (4.1.2, discussion).
7. In both case studies, biogas technology and the plastics industry, international stakeholder involvement has contributed to some extent to circularity/innovation in Indonesia through the introduction of initiatives, programmes and effective implementation. On the other hand, it can be noted that the initiatives and programmes at the bottom in Indonesia are mainly from with international stakeholders, which means that the level of local initiatives and programmes in Indonesia is weak (4.1.2; 4.2.2, discussion).
8. In Indonesia, the cases of waste management and the pulp and paper industry illustrate the lack of awareness of circular innovation, which has been somewhat mitigated in the case of biogas technology by the effective dissemination of NGOs and the involvement of Indonesian government agencies (4.1.1; 4.1.2; 4.2.2; 4.3.2, discussion).
9. In the European cases studied, a networked learning process towards circularity/innovation emerged in the face of multiple issues such as global competitiveness and environmental concerns (4.3.3, discussion).
10. In the cases studied, a high degree of corporate initiative, planning and innovation can be seen as important drivers for achieving circularity, which provides the basis for the development of further circular innovations (4.1.2; 4.1.3, discussion).
11. In the European countries studied, competition and cooperation between stakeholders engaged in recycling-related work can lead to circularity/innovation (4.2.3, discussion).
12. It has been observed that many European companies aim to solve environmental problems and thus implement environmental innovations,

while some Indonesian companies pretend to implement environmental protection with the real aim of making money. However, it cannot be ruled out that there are also individual cases of such "pretending" and window dressing in European countries (4.3.3, discussion).

13. The lack of mutual trust in individual companies and the lack of an equitable and transparent business environment are evident in Indonesia (4.3.3, discussion).
14. There may be a different mindset between stakeholders in Indonesia and those in Europe studied, with stakeholders in Indonesia acting more introverted (closed group) and seeking improvements for themselves, while stakeholders in Europe act more extroverted (cooperative) and look for what other stakeholders can do with the products (or by-products) they produce (4.3.2, discussion).
15. The efficiency and effectiveness of the state, civil society and individual enterprises in implementing circularity/innovation has been positively demonstrated in the European countries studied. The beneficial interaction between the various levels had a positive contribution to circularity/innovation. However, in Indonesia, although the state, civil society and individual enterprises were all involved in the implementation of circularity/innovation, the interaction between them was less efficient and effective than the former, as unclear vision-setting and over-intervention by the government, poor citizen behaviour and a lack of local initiatives and planning may have hindered the interaction between the various levels when it comes to circularity/innovation, as was observed to some extent (4.4.2, discussion).
16. Indonesia, which is to a large extent close to System I, is at risk of excessive state intervention and over-dependence of stakeholders on relationships, while for the European countries studied, which are close to System II, there may be a risk of too much corporate individualism and liberal behaviour at the expense of the role of the state. Thus, the role of Systems I and II in the implementation of circularity/innovation is not black and white, but more or less so (4.4.3, discussion).

5.2 Recommendations

1. Policy development in Indonesia needs a clear direction based on the specific application aspects of renewable energy systems/environmental innovation technologies (4.1.1, discussion).
2. The creation of equal opportunities for each stakeholder and reasonable judgement of stakeholder actions by the Indonesian government can help to implement circular/innovation objectives and policies (4.1.1, discussion).
3. The Indonesian government needs to put into practice the rule of law and policy enforcement, as well as promote right citizen behavior, to address policy implementation deficiencies in waste management (4.2.1, discussion).
4. Based on the experience of the European countries studied, the state leaves the space for initiation and implementation to civil society and individual

enterprises, while policy development is strictly focused on R&D, which could serve as a reference for more effective implementation of circularity/innovation in Indonesia. In addition, responsible and adaptive interventions by the state may benefit individual firms in Indonesia in terms of circularity/innovation (4.2.1, discussion).

5. Transparency, equity and policy enforcement between the Indonesian government and enterprises need to be improved (4.3.1, discussion).
6. It is recommended that the role of NGOs in Indonesia is primarily to assess the circularity/innovative progress of projects, leaving the space for implementation to local stakeholders (4.2.2, discussion).
7. It is recommended that farmers in Indonesia shift from independent use of biogas digestate facilities to cooperative use. Farmer initiative and planning, as well as awareness of the potential benefits of biogas technology, are key to this shift (4.1.2, discussion).
8. In Indonesia and Europe, the popularisation of environmental education in primary and secondary schools can help to bring about behavioural change towards circularity (4.2.2, discussion).
9. It is recommended that specialist design teams provide planning and innovation for circular product services at both the production and consumption stages, and work with multiple industries in Indonesia. In this way, the lack of a collaborative attitude towards circularity/innovation among producers and consumers in Indonesia can be improved (4.2.2, discussion).
10. Promoting the use of reusable food packaging on Indonesia's tourist islands based on cross-sectoral cooperation between the tourism and food packaging industries has the potential to solve the problem of marine plastic waste (4.2.2, discussion).
11. It is recommended that foreign companies with advanced technology and local Indonesian companies establish open cooperation and mutual trust in circularity/innovation. At the same time, local Indonesian companies can strengthen their initiatives and planning for a circular economy by solving specific problems and building their corporate image (4.3.2, discussion).
12. It is recommended that large companies in Indonesia take a leadership role in circularity/innovation, for example by creating a circularity/innovation infrastructure network (business environment) to facilitate new stakeholder engagement (4.1.3, discussion).
13. Upgraded waste treatment technologies could be implemented in the informal waste sector in Indonesia to generate more value from waste (4.2.3, discussion).
14. Promoting plurality of ideas and strategies in Indonesian companies could enable innovation to be implemented (4.3.3, discussion).
15. Individual companies in Indonesia could be advised to develop an extrovert mentality, which may help them to collaborate and move forward more quickly in terms of circularity, and in the process, they may be able to address sustainability issues at an accelerated pace in this way (4.3.3, discussion).

5.3 Limitations, research implications and recommendations for further research

This section begins by reflecting on the limitations of this study. It then explores the implications of this study for scientific research related to circularity/innovation. Further relevant research recommendations based on this study are also presented.

5.3.1 Study limited to making a first impression

This study examined a number of cases and examples. In the process, projects of different sizes, dimensions and implications were thrown into a basket. In this way, this study provides a general description and impression of these cases and examples as a first step towards knowledge. This study therefore minimises claims to very present and convincing knowledge and limits itself to giving a first impression.

5.3.2 Impact of data updates on circularity/innovation implementation in Indonesia and Europe on this study

Data collection for this study took place primarily between late 2020 and mid-2021. Data related to circularity/innovation implementation will be updated over time, for example some specific cases being implemented in early 2021 may have been completed by mid-year, but this study will use data from the beginning of the year, which may result in individual elements of this study (e.g. in the case descriptions and identifications of implementation process) not matching the latest data. However, as explored in the discussion chapter, circularity/innovation implementation in both the European countries studied and Indonesia is moving in the zone between System I and System II, which are the methodological pillars of the study as a whole, so the impact of the data update on this study is minimal, as both European countries and Indonesia are still far from full circularity, they are both in the process of implementation, only the degree of implementation differs.

5.3.3 Some thematic extensions related to circularity/innovation

Through this study, several important extended themes of circularity/innovation have been brought to light. Themes related to norms and ethics in the implementation of circularity/innovation have been highlighted in this study (4.4.4, discussion). Thus, the research section on norms and ethics needs to receive more attention in research related to circularity/innovation. In addition, research on the science of communication, negotiation and dialogue is also important in circularity/innovation implementation (4.4.3, discussion). Therefore, we recommend more research on the topic of interaction, e.g. relevant research on interactive processes.

5.3.4 Implications for literature-based research

This study provides some insights into literature-based research. The determination of the research topic, the research questions and the establishment of the research model are critical in literature-based research. In the experience of this study, fixing all these elements before conducting the research is almost impossible to achieve, i.e. they will be constantly adjusted during the research process. In this case, the advice given in this study is to fix at least some important components such as the theoretical model of the study and the research questions first, and then leave room for improvement in other areas such as the research topic. (The fixed elements chosen for this study are of course not generally applicable to other literature-based studies). In addition, the whole research process can take a considerable amount of time and the difficulty lies in the uncertainties encountered in setting the time and corresponding tasks, e.g. it is often difficult to complete a research task within the set time frame as the literature research process generates a number of new and relevant elements. In this regard, the advice provided by this study is that it is necessary to establish a time frame beyond which any data found is considered invalid. This recommendation may sound rather decisive, but in the face of a flexible and changing form of research it is important to set out definitive principles.

5.3.5 Implications for comparative case studies

This study sheds some light on comparative case studies. In comparative case studies, the selection of cases and regions is extraordinarily important, and these components can be determined before starting the study or changed during the course of the study. In order to increase the efficiency of the study, the advice given in this study is that it is necessary to define the cases and regions before starting the study, so that the structure of the comparative case study is relatively certain and it is feasible to add or delete some case details. Moreover, comparative case studies may have inconsistent findings with expectations, and in such cases it is important to describe and explain the case comparison factually. It is also crucial and recommended that the research model is established as a priority, as it determines how the comparative case study process will be conducted, i.e. the structure of the comparative case study is fixed first, so that the research process becomes smoother. To be specific, prior to the analysis, comparisons between different comparative items need to be established, and here it is recommended that the form and content of the comparisons established be as diverse as possible, which means adding more possible comparability between the different comparative items, from which more valuable content will be generated (Appendix 1, comparison of European countries and Indonesia). Furthermore, the establishment of such a comparative structure also facilitates literature-based research and can promote certainty and diversity of research content.

5.3.6 Recommendations for further research

Based on this study, it is recommended that the next step is to conduct a study similar to this study on a wider range of different cases and industries in Indonesia and the European countries studied, thus providing useful insights and strategies for implementing circularity/innovation for a broader range of stakeholders in the field. It is also recommended to expand and change the regional context of the study by conducting comparative case studies similar to this study between other countries in Europe and the Global South and other countries in developing regions, while an increase in the number of comparative cases and countries could be considered. Furthermore, it is recommended to examine how the insights and strategies derived from this study can be used by relevant stakeholders to achieve circularity/innovation, or how to optimise the decision-making process of relevant stakeholders in implementing circularity/innovation.

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Appendix 1: The comparison between European countries and Indonesia

This part focuses on answering the following research question:

What distinctive characteristics can be identified behind the implementation of circularity/innovation in European countries and Indonesia and what case comparisons can be established between European countries and Indonesia?

For clarity, the elements of comparison between European countries and Indonesia are presented in tabular form. Three tables have been generated below to show the three case studies. The factual descriptions in the tables below can be matched to the headings in the case description chapter. The distinctive characteristics refer to the distinctive characteristics of System I and System II (Kroesen et al, 2020) (2.3 Theoretical framework; 4.4.5 Adjusted social transformation model). Cross-sectionally, European countries and Indonesia were compared in terms of implementation progress, factual descriptions and distinctive characteristics. However, when a blank space (N/A) is left on one side (European countries or Indonesia), it means that there is no comparable factual description there, a situation that can also lead to comparisons or to a one-sided analysis. Furthermore, in order to establish potential comparisons between the cases of European countries and Indonesia, the factual description can be repeatedly applied to compare with another one. Ultimately, the analysis of these comparisons can be found in the discussion chapter.

Interpretation of abbreviations in tables:
IP: implementation progress, P: positive, N: negative, O: ongoing, D: no concrete data

Biogas technology

	Finland			**Indonesia**		
	IP	**Fact description**	**Distinctive characteristic**	**IP**	**Fact description**	**Distinctive characteristic**
State	P	Technology policy: applying new innovations in combination with existing	Accountability in issuing policies for the innovation	N	Inconsistencies in policies related to the energy sector	Less accountability in issuing policies

		technologies in the transport sector				
	P	Support policies for electricity production in biogas plants; Adequate and reasonable investment subsidies for biogas plants	Accountability in issuing policies for the innovation, equal access to stakeholders, justice of stakeholder actions, transparent regulations for innovation	N	Regulatory uncertainty between the public and private sectors	Less equal access between public and private sectors, Less transparent regulations between public and private sectors, less accountability in issuing policies between public and private sectors
	P	Support policies for electricity production in biogas plants; Adequate and reasonable investment subsidies for biogas plants	Accountability in issuing policies for the innovation, equal access to stakeholders, justice of stakeholder actions, transparent regulations for innovation	O	National projects initiated by the government in the agriculture and forestry sector (small-scale biogas)	Accountability for national projects
	P	Support policies for electricity production in biogas plants; Adequate and reasonable investment subsidies for biogas plants	Accountability in issuing policies for the innovation, equal access to stakeholders, justice of stakeholder actions, transparent regulations for innovation	O	Launch of biogas plant targets and policies	Accountability in issuing policies
	O	High adjustability of policies	Accountability in issuing policies for the	P	Effective communicatio n with	Accountability for communication with stakeholders

		based on practical performance	innovation, equal access to stakeholders		stakeholders (e.g. farmers) through extension agencies (e.g. farmer groups, forestry agencies) with the support of the Indonesian government	of innovation, multiple memberships of extensive actors
Civil society	N	Inconsistencies in application between multiple sectors hinder the implementation of innovations	less open cooperation between the multiple sectors (or multi-stakeholders), less open attitude of multi-stakeholders, less mutual adaptation between the multiple sectors, less pluralism of opinions from the multiple sectors, less mutual trust between multi-stakeholders	P	Emerging initiatives and implementation from multiple international actors	High degree of initiative, planning and innovation by international NGOs in Indonesia, open cooperation between international NGOs and domestic stakeholders, mutual adaptation between international NGOs and local environment, professional and cooperative attitude of international NGOs, mutual trust between NGOs and local stakeholders
	P	Unbalanced forms of implementation between dominant and non-dominant	Less shifting alignments and coalitions between mainstream sectors and non-	P	The market approach triggers multi-stakeholder participation in the	Open cooperation between multi-stakeholders, open and cooperative attitude of multi-stakeholders,

		sectors; negotiations formed between stakeholders in non-dominant sectors	mainstream sectors (less mutual adaptation between mainstream sectors and non-mainstream sectors), less pluralism of opinions from sectors, low degree of initiatives in non-mainstream sectors, less planning and innovation in non-mainstream sectors & Open cooperation and mutual adaptation between multi-stakeholders in non-mainstream sectors, both of competition and cooperation between multi-stakeholders in non-mainstream sectors, planning and innovation of multi-stakeholders in non-mainstream sectors, cooperative attitude of multi-stakeholders in		implementation of the innovation	mutual adaptation between multi-stakeholders, multiple memberships for innovation, high degree of planning and innovation of the project, both of competition and cooperation between competitors

			non-mainstream sectors			
	N/A	N/A	N/A	P	Training and education for individual enterprises to facilitate the spread of innovation	Open cooperation between NGOs and individual enterprises, professional attitude of NGOs, open and cooperative attitude of multi-stakeholders, high degree of initiative and planning by NGOs
	N/A	N/A	N/A	P	Effective dissemination of innovation and customer acceptance	Planning and innovation of market development and user diffusion, professional attitude of individual enterprises/related stakeholders, open and cooperative attitude of customers for products, open cooperation and trust between individual enterprises/related stakeholders and customers
	P	Communication between civil society actors and policy makers and multiple sectors with the aim of biogas	Open attitude of multiple sectors/multi-stakeholders, open cooperation and mutual trust and adaptation between	N/A	N/A	N/A

		technology implementation	multiple sectors/multi-stakeholders, pluralism of opinions for innovation			
	P	Cooperative biogas plants: open cooperation between multiple farms	Both of competition and cooperation between multiple farms, planning and innovation of multiple farms, cooperative attitude of farmers, open cooperation, mutual trust and adaptation between multiple farms, open attitude of farmers, complementary relations between multiple farms	N/A	N/A	N/A
	P	Biofuel supply chains expanded due to the use of biofuel vehicles and the construction of farm-scale refuelling plants	Open cooperation at the bottom, open attitude of customers and farmers, high degree of initiative, planning and innovation by farmers	N/A	N/A	N/A
Individual enterprise	N	Inconsistencies between the state and individual enterprises in the implementati	Low degree of initiatives of individual enterprises, less planning and innovation of individual	P	The market approach triggers multi-stakeholder participation in the	Open cooperation between multi-stakeholders, open and cooperative attitude of multi-stakeholders,

		on of innovations	enterprises		implementation of the innovation	mutual adaptation between multi-stakeholders, multiple memberships for innovation, high degree of planning and innovation of the project, both of competition and cooperation between competitors
	P	Establishing biogas refuelling stations on farms; Large companies build biofuel infrastructure and demand, stimulating new stakeholder engagement	High degree of initiatives of farmers/stakeholders, high degree of planning and innovation by farmers/stakeholders, cooperative attitude of farmers/stakeholders, open cooperation between farmers and the stakeholders in the biofuel supply chain	N	Difficulties for customers (e.g. farmers) in installing, using and maintaining biogas facilities)	Less open cooperation between individual enterprises and customers, less planning and innovation of market development and user diffusion, less professional and cooperative attitude of individual enterprises, less cooperative attitude of customers; Open cooperation (at the bottom), planning and innovation of large company, high degree of initiatives of middle and small size companies
	N/A	N/A	N/A	P	Interdisciplinary partnerships for innovative	Professional attitude of interdisciplinary partnership,

					implementation	cooperative attitude of the multiple actors in interdisciplinary partnership, mutual trust among the multiple actors in interdisciplinary partnership, team building of interdisciplinary partnership, instrumental working relations among the multiple actors in interdisciplinary partnership, multiple memberships, pluralism of opinions
	P	High level of proactivity of individual enterprises towards government policy	High degree of initiative and planning by individual enterprises	N/A	N/A	N/A

Circularity of plastics

	Germany			**Indonesia**		
	IP	**Fact description**	**Distinctive characteristic**	**IP**	**Fact description**	**Distinctive characteristic**
State	P	Synchronising national regulations with EU requirements	Rule of law for innovation in the EU and Germany, accountability in issuing policies for	N	Poorly enforced policies on waste management	Less strong and accountability (of local governments) for innovation, lack of policy enforcement of

			innovation between the EU and Germany, policy enforcement between the EU requirements and national targets for innovation, cooperative attitude of national policy making, justice between the EU requirements and national targets			citizens for innovation, Lack of justice in people's behaviour, less cooperative attitude of people
	P	Synchronising national regulations with EU requirements	Rule of law for innovation in the EU and Germany, accountability in issuing policies for innovation between the EU and Germany, policy enforcement between the EU requirements and national targets for innovation, cooperative attitude of national policy making, justice between the EU requirements and national targets	D	Waste data monitoring implemented by local and national governments	Rule of law by local and national governments, strong but accountability of local and national governments, obedience to local and national governments
	P	Synchronising national regulations with EU	Rule of law for innovation in the EU and Germany,	D	National and international cooperation on plastic	Accountability for innovation, universalism in marine plastic

		requirements	accountability in issuing policies for innovation between the EU and Germany, policy enforcement between the EU requirements and national targets for innovation, cooperative attitude of national policy making, justice between the EU requirements and national targets		waste management organised by the government	waste management
	P	Sector- and firm-specific innovation support policies	(Strong)Accountability for innovation, professional attitude of innovation	D	Launching and supporting a range of plastic waste management schemes through state intervention	Accountability for innovation, professional attitude for innovation, high degree of initiative by state intervention
	O	Regulatory transparency and legislation in the (plastics) packaging supply chain	Rule of law for innovation, strong state institutions for innovation, transparency of the packaging supply chain, a corporative attitude (including give and take) of stakeholders involved in innovation	P	Decentralisation of regulations and policies on waste management to Indonesian city governments and citizens	Obedience of city governments and citizens, accountability of city governments, initiative and planning from city governments, policy enforcement of citizen tariffs, justice in the civil tariff system
	P	Efficient development	Rule of law for innovation,	N/	N/A	N/A

		of legislation through multi-stakeholder participation	accountable state institutions in issuing policies for innovation, transparency in generating policies	A		
Civil society	P	Product design triggers system change (lifestyles, business models and supply chains) towards circularity	Open cooperation between multi-stakeholders in the product supply chain, open attitude of multi-stakeholders in the product supply chain, professional attitude of product design, high degree of initiative from customers, high degree of planning and innovation of the circular product service, cooperative attitude of multi-stakeholders in the product supply chain, complementary relations between multi-stakeholders, mutual trust between multi-stakeholders in the product supply chain (instrumental working relations	N	People's waste disposal practices violate the principle of circularity	Less civil society, less cooperative attitude of citizens

			between multi-stakeholders in the product supply chain, contract by multi-stakeholders).			
	N	Difficulties encountered by consumers in disposing of plastic packaging	Less planning and innovation of product, less professional and cooperative attitude of individual enterprises, less cooperative attitude of customers	P	A shift from sustainability to circularity is occurring based on the commercial considerations of individual companies	High degree of initiative from individual companies, high degree of planning and innovation from individual companies, cooperative attitude between multi-stakeholders in the circular supply chain, open attitude of customers, mutual adaptation between individual companies and customers, complementary relations between the multi-stakeholders in the circular supply chain, mutual trust between the multi-stakeholders in the circular supply chain
	P	Joint implementation in different industries (e.g. food	Open cooperation across different industries, open attitude of	N/A	N/A	N/A

		packaging industry and tourism industry)	multiple industries, mutual adaptation between different industries, open attitude of customers, high degree of planning and innovation between different industries, cooperative attitude between different industries, instrumental working relations between different industries, mutual trust between different industries, complementary relations between different industries			
	P	The regional authorities create an advisory platform for individual companies	Open cooperation between district authority and individual enterprises, mutual trust between individual enterprises and district authority, high degree of	D	Research activities to address the plastic waste problem	Open cooperation between organizations, open attitude of organizations, multiple memberships in the platform

			initiative from individual enterprises, cooperative attitude of individual enterprises, equal treatment of individual enterprises			
	O	Emerging consumer behaviour change programmes	Open attitude of consumers	P	Multi-stakeholder school waste cycling education	Civil society, open attitude and cooperation between multi-stakeholders, mutual adaptation between multi-stakeholders, professional attitude in primary school education, team building of teaching, high degree of planning and innovation in primary school education, mutual trust between multi-stakeholders, transparent operation in primary school, high credibility of primary school
	O	The emergence of innovation based on the cooperation between individual company and research	Open cooperative between individual enterprise and research institute, professional attitude of the	P	Technology upgrade for waste management by individual companies supported by local government	Professional attitude of individual enterprises, high degree of initiative, planning and innovation from individual

		institution	cooperative project, innovation between individual enterprise and research institute, cooperative attitude between individual enterprise and research institute, mutual trust between individual enterprise and research institute			enterprises, cooperative attitude between individual enterprises and local governments, equal treatment of individual enterprises, open attitude of local governments, mutual adaptation between local governments and individual enterprises, mutual trust between local governments and individual enterprises, open cooperation between local governments and individual enterprises, complementary relations between local governments and individual enterprises
	N/A	N/A	N/A	P	Cooperation in the establishment and widespread implementation of a waste bank in Medan; Cooperation between international stakeholders and local	International cooperation for innovation, open attitude of local governments, open cooperation between local governments and NGOs, mutual adaptation between local governments and NGOs, professional

					authorities leads to reduction of marine plastic waste; Organising community events to tackle the plastic recycling problem	attitude for innovation, high degree of initiative and planning from local governments and NGOs, cooperative attitude between local governments and NGOs, team building by NGOs and local governments; Open cooperation between international stakeholders and local governments, open attitude of local governments and citizens, professional attitude for innovation, high degree of initiative, planning and innovation, cooperative attitude of local governments and citizens; Civil society for innovation, open attitude of citizens, pluralism of opinions for innovation, citizen's trust in innovation, professional attitude for innovation, high

						degree of initiative, planning and innovation, cooperative attitude of citizens, team building for innovation, open labor market, instrumental working relations for innovation
Individual enterprise	P	A closed-loop supply chain for plastics (i.e. PVC)	High degree of initiative, planning and innovation of Rehau (business model), open cooperation among the actors in the closed-loop PVC supply chain, mutual adaptation between the actors in the closed-loop PVC supply chain, professional attitude of the actors in the closed-loop PVC supply chain, both of competition and cooperation between recycling competitors, complementary relations between the actors in the closed-loop PVC, mutual	N	Household waste services in Indonesian cities	High degree of initiative from the informal waste sector, cooperative attitude of multi-stakeholders in the waste service, instrumental working relations between multi-stakeholders in the waste service, multiple memberships in the informal waste sector, open cooperation between local governments and the informal waste sector, Less planning and innovation in the informal waste sector, less cooperative attitude of citizens, less professional attitude in the informal waste sector, less mutual trust between waste

			trust between the actors in the closed-loop PVC			service and customers, Lack of credibility of the informal waste sector
	N	Improper waste handling at individual companies	Lack of transparency in the company operation, less planning and innovation of individual company, less cooperative attitude of individual company, no open cooperation between individual company and third-party service, Lack of credibility of individual company	P	A shift from sustainability to circularity is occurring based on the commercial considerations of individual companies	High degree of initiative from individual companies, high degree of planning and innovation from individual companies, cooperative attitude (open cooperation) between multi-stakeholders in the circular supply chain, open attitude of customers, mutual adaptation between individual companies and customers, complementary relations between the multi-stakeholders in the circular supply chain, mutual trust between the multi-stakeholders in the circular supply chain
	P	Incentives for individual enterprises to promote the implementation of circular	High degree of initiatives of individual enterprises, complementary relations	P	A shift from sustainability to circularity is occurring based on the commercial	High degree of initiative from individual companies, high degree of planning and

		business models	between multi-stakeholders in the circular supply chain		considerations of individual companies	innovation from individual companies, open attitude of customers, mutual adaptation between individual companies and customers, complementary relations between the multi-stakeholders in the circular supply chain, mutual trust between the multi-stakeholders in the circular supply chain
	P	The important role of consulting in supporting individual businesses	Professional attitude of consulting, planning and innovation of individual enterprises, open cooperation and mutual trust between individual enterprises and consulting services, high credibility of consulting services	N	Individual companies' and customers' perceptions of the safety of reusable plastics	Uncertainty avoidance for innovation, less open attitude for innovation, less planning and innovation by individual companies, less professional attitude of individual companies, less cooperative attitude of customers, lack of mutual trust in individual companies and customers
	P	The important role of consulting in	Professional attitude of consulting, planning and	N	Issues surrounding informal waste disposal	Reduced level of initiative within the informal waste sector,

		supporting individual businesses	innovation of individual enterprises, open cooperation and mutual trust between individual enterprises and consulting services, high credibility of consulting services		workers	open labor market
	N/A	N/A	N/A	P	Improving job satisfaction for waste operation workers	Equal treating for waste workers, team building of waste workers, planning and innovation by individual enterprises,mutual trust and adaptation between individual enterprises and waste workers, accountability of issuing policies for improving job satisfaction of waste workers

Innovations in the pulp and paper industry

	Sweden			**Indonesia**		
	IP	**Fact description**	**Distinctive characteristic**	**IP**	**Fact description**	**Distinctive characteristic**
State	P	State intervention	Accountability in issuing	N	Individual enterprise	Lack of rule of law, lack of

		in individual enterprise innovation	policies to support individual enterprise for innovation, mutual trust and adaptation between state and individual enterprise, cooperative attitude between state and individual enterprise, policy enforcement of issued policies, high credibility of individual enterprise		violating regulations and uncertain government responses	transparency and justice between state and individual enterprise, Lack of credibility of individual enterprise, lack of strong and accountable state institutions to deal with the regulation violation of individual enterprise, lack of policy enforcement
	P	State intervention in individual enterprise innovation	Accountability in issuing policies to support individual enterprise for innovation, mutual trust and adaptation between state and individual enterprise, cooperative attitude between state and individual enterprise, policy enforcement of issued policies, high credibility of individual enterprise	N	Issuing strict land environmental management regulations for the pulp and paper industry	Accountability in issuing policies, but comparing with another fact (Individual enterprise violating regulations and uncertain government responses), the further outcomes are: lack of rule of law, accountability and policy enforcement, possible personalisation and particularisation between state and individual enterprises
	P	Implementing a series of	Accountability in addressing	N	Issuing strict land	Accountability in issuing policies,

		environmental regulations of the pulp and paper industry	environmental issues from the pulp and paper industry		environmental management regulations for the pulp and paper industry	but comparing with another fact (Individual enterprise violating regulations and uncertain government responses), the further outcomes are: lack of rule of law, accountability and policy enforcement, possible personalisation and particularisation between state and individual enterprises
	O	Existing regulations for the reuse of sludge	Accountability in issuing policies	O	Issuing ecosystem restoration permits to stimulate individual enterprises to meet regulatory requirements	Accountability in issuing policies (not certain in terms of the transparency and fairness between the government and individual companies), high degree of initiative from individual enterprises
Civil society	P	Cross-national cooperation converting the wastewater from pulp and paper mills into the energy source	Open cooperation, mutual trust and mutual adaptation between Swedish paper mill and Finnish energy company, high degree of initiative,	N/A	N/A	N/A

			planning and innovation between Swedish paper mill and Finnish energy company, cooperative attitude of multi-stakeholders in the circular supply chain, Open cooperation of multi-stakeholders in the circular supply chain			
	O	Strategic innovation of waste reuse in pulp and paper mill (i.e. Reusing fibre sludge for paint thickener; Reusing Green Liquor Dregs for sealing layers) in collaboration with cross-industry individual enterprises and research support provider (and research institute)	High degree of planning and innovation, professional attitude of multi-stakeholders in the waste circularity, open cooperation (cooperative attitudes), mutual trust and mutual adaptation between multi-stakeholders in the waste circularity, complementary relations between multi-stakeholders in the waste circularity	O	The existing circular strategies and implementations of individual enterprises	High degree of initiative and planning by individual enterprises, open cooperation (cooperative attitude) between multi-stakeholders
	O	Research-based strategies of	High degree of initiative, planning and	O	Existing strategic suggestions of	High degree of initiative from foreign experts,

		individual company in the pulp and paper industry	innovation of individual company, cooperative attitude between individual enterprise and research body, open cooperation between individual enterprise and research body, pluralism of opinions for innovation		circularity from abroad	professional attitude of foreign experts
	O	Innovative research project on the application of waste sludge	Open cooperation between multi-stakeholders, open attitude for innovation, multiple memberships of multi-stakeholders for innovation, pluralism of opinions for innovation, professional attitude for innovation, high degree of initiative from innovative research	N/A	N/A	N/A
Individual enterprise	P	Pulp and paper industry's transition to energy efficiency in response to global	High degree of initiative, planning and innovation among global competence, electricity market and pulp	N	Inconsistency between the initiative and implementation of individual enterprise	Lack of planning and innovation of individual enterprise, lack of cooperative attitude of individual enterprise, Lack

		competence and electricity market challenges	& paper industry			of credibility of individual enterprise, lack of the justified and transparent business environment
	P	Pulp and paper industry's transition to energy efficiency in response to global competence and electricity market challenges	High degree of initiative, planning and innovation among global competence, electricity market and pulp & paper industry	O	Individual enterprise establishing the policies, environmental assessment methods, advisory committee and monitoring department to address the sustainable land management	High degree of initiative, planning and innovation by individual enterprise, team building of individual enterprise for sustainable land management
	P; O	Significant investment in environmental innovation by pulp and paper producers; Environmentally friendly paper products produced by local integrated paper mill	Professional attitude for environmental innovation, high degree of initiative, planning and innovation, team building of environmental R&D; High degree of initiative, planning and innovation by paper mill, cooperative attitude and professional attitude of multi-stakeholders in the paper supply chain, open	O	Individual enterprise establishing the policies, environmental assessment methods, advisory committee and monitoring department to address the sustainable land management; The existing circular strategies and implementations of individual enterprises	High degree of initiative, planning and innovation by individual enterprise, team building of individual enterprise for sustainable land management; High degree of initiative and planning by individual enterprises, cooperative attitude between multi-stakeholders, open cooperation between multi-stakeholders

			cooperation between multi-stakeholders in the paper supply chain, complementary relations multi-stakeholders in the paper supply chain			