Business decision-making in linear-circular economy transitions

DIANE ZANDEE

READ THE WORDS AND FEEL THE BEAT

Business decision-making in linear-circular economy transitions

Financial and accounting barriers in making the 'sustainable' decision.

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CHAPTER 6

Conclusions

"Life is a lot like jazz…it's best when you improvise."
George Gershwin

6.1 INTRODUCTION

This thesis aims to respond to the central research question "*How can strategic decision-making in linear-circular economy transitions be facilitated to overcome the accounting and financial hurdles in terms of providing information on both risk and value?".* In this concluding chapter the main insights of the chapters will be summarized to answer this central research question.

To answer this research question, the following sub-questions were formulated:

1. *What are the strategic and tactical approaches of organizations on the circular economy pathway of decision-making?*
2. *What is the current perspective of financiers and accountants on (the value of) circular business models?*
3. *What are the financial and management accounting frictions to overcome transition from linear to CE?*
4. *How can linear-circular transitions be supported in decision-making by information to reflect the value and the risks of the circular economy?*

In the following paragraphs, the sub-questions will be answered, based on the results from the previous chapters. Subsequently, the limitations of this research and recommendations for future research will be presented.

6.2 CONCLUSIONS OF THE SUB-STUDIES

Chapter 2 presented a dartboard metaphor, reflecting strategic paths that can be identified as the strategic decisions needed for both the internal and external development of the organization. First and foremost, in relation to the organizational positioning towards sustainability and more specifically towards circular economy, incorporating CE in the organizational strategy is crucial. And subsequently in coordination with customers and suppliers to make the journey together. This requires a different conversation between customers and suppliers, often organised in pilot projects to learn with one another. Sometimes organizations already take it a step further and set long-term goals together to increase accountability and demand commitment to real change. The interaction between supply chain partners was also described in chapter 4. To shape the CE, collaboration between companies is needed to build a new

ecosystem, aligning material use, design and repairability with each other. It is not only *within* companies that cooperation needs to be redefined, but also *between* companies. All departments within an organization work with budgets and financial performance. In addition, the financial playing field is an interaction between contracts from legal expertise and accounting structures in order to process this correctly in the accounts, after which shareholders or investors use these accounts to analyse an organization's performance. The interaction between the experts is essential to implement circular principles into linear structures. Contracts are a translation of the circular incentives, agreements and responsibilities. A contract may still be open-ended or entered into for the long term, but then there are no financial institutions willing to lend money against it, as they have a risk-averse approach. However, this is desirable to be able to make clear agreements between market parties and reduce risks.

Where strategic decisions from an organizational perspective often focus on one's own organization, as described in chapter 2, the CE in particular requires a holistic view of the strategic initiatives needed to build a new supply chain. Even in the Netherlands, which is considered a frontrunner, only the first steps in the circular economy are taken because the holistic picture is missing. Each organization has (yet) to choose its own internal positioning, which takes time. From the whole picture of the value chain, it becomes clear that the production side needs certainty from the customer side, where currently the requirements are still based on products, materials and fittings. There is thus a misalignment of the current power in the chain and the steps to make large investments. As each player is still learning how this new game works, we cannot (yet) give each other assurances. This is where the government could play a role by setting targets per sector, but this is not happening (yet).

Since only limited assurances can be given between market players, the more vital it is that the development towards CE is made on the basis of trust. Trust is crucial to take bigger steps in development and to work together based on other principles, as illustrated in chapter 5. Long-term collaboration, letting go of control by outsourcing maintenance also with construction assets to optimize the long-term value of raw materials is exciting. It requires broad support within the organization and trust from various people at the start of

a project and during the operational process. A condition for this is that CE is more widely supported and understood within the organization.

The development paths that were described in chapter 2 require both long-term and short-term actions to achieve radical change on the one hand and build support and trust in the short term on the other. The frontrunners realize that CE will require a different way of working, with different materials and different skills. Standardization of modules is highlighted or availability of information about the materials that have been used in a material passport. These kinds of agreements are not easily reached across the industry. Therefore, short-term experiments in cooperation and alignment on 'low-hanging fruit' are being conducted first. At the same time, long-term actions are being taken to enable other solutions. Sometimes these long-term actions are prompted by impeding regulations, sometimes by introducing larger-scale solutions (marketplaces for recyclable materials) or infrastructure (return logistics). This way, a longer period is set aside for learning, where outside -the-box thinking is also allowed.

In this environment of uncertainty about the future, there is a need for data to reduce this uncomfortable position, as described in chapter 2. Information about the CE, what it brings and what the risks are, since risks are not thoroughly evaluated by many organizations when starting with this CE development pathway. Examples of successful business models are very much needed. Therefore, without a business case, most companies start in pilot projects to find out together what the benefits and risks are. However, there is a widely held view that scarcity of materials and restrictions in CO2 emissions will increase in the (near) future. That view is sufficient to substantiate benefits and risks on a qualitative level. There is great uncertainty when it will deliver the benefits for the organization, but there is conviction that CE will deliver benefits. With that, the organization will have a first mover advantage, but it cannot do it alone. Collaboration with the value chain partners is required.

The role of data in reducing risk and make value more explicit is described in chapter 4 as well. This chapter illustrates the difficulties in capturing and valuing CE's ambition to make products last longer, by redesigning the product, making repairs easy, using different materials and then being able

to reuse them continuously. But due to the transaction-oriented nature of current accounting structures, the comparison takes place on transaction value, purchase price and lifespan does not weigh, or hardly weigh, in the traditional comparison. The longer intended lifetime and the reusability of materials are both values that translate into financial value over time, which would justify a higher initial price. But the aspects of reusability and longer life are both uncertain. There is a lack of information to properly assess this and substantiate it financially. Thus, the long-term useful life of a circular product or project conflicts with a short-term profit expectation and accounting rules that require certainties.

The linear economy focuses on transactions with an economic value, as described in chapter 4. The product and the underlying transaction are supportive of this and with this method, both financial and ecological values need to be balanced. This makes the economic principles of linear and circular economy different and of circular more comprehensive. For the ecological values, there is no structure to weigh up, so the frameworks of consideration, of assessment in strategic decision-making are based on a linear economy from the financial frameworks.

Quantitative data are often not available and are described using the interviews that formed part of the research in Chapter 5. When it comes to future value, this value may be determined by how collaboration is coordinated or how incentives are integrated into this collaboration to optimize design, production and maintenance to realize the highest product quality level. In short, there is a lot of uncertainty, which means that the aforementioned trust and the expression of intentions play a greater role. That is why it is even more important that these intentions and principles are identified with qualitative data and a flexible collaboration model is designed, so that adjustments can be made when necessary.

Chapter 3 described the perspective of accountants and financiers on the CE business models. It is important to understand how they view the circular economy, since they have a role in assessing business propositions and are advisors in feasibility of strategic pathways and decision-making. To understand the CE values, the principles of how linear business is assessed

were investigated. A balance between risk and return plays a role in this. This is translated into systems of balance sheet, P&L and cash flow statements, where sector by sector, comparisons can be made using ratios. These structures also form the basis on which also a circular business is assessed. However, this does not work well, because circular business has different assumptions and these cannot be reflected in the current structures. Specific elements in (linear) accounting structures which are limiting are: (1) Generate cash quickly. Based on the waste-make-dispose principles, it is important to earn money as quickly as possible. In a sales model, an organization benefits from seeing the buyer again quickly for a new purchase, for example if the product breaks quickly. In the CE, long usage of product – sometimes by multiple customers is a key element of longevity. (2) Reduce depreciation periods. From a risk-averse attitude, it is important to depreciate assets as quickly as possible. This raises the cost level and reduces profits, which conveys a cautious attitude and gives accountants confidence. In CE longevity of products is an important aspect, where depreciation should be as long as possible to a much higher level of residual value than we are used to when we dispose in the linear economy, since we are re-using the product or even materials. These conflicting principles will lead to wrong conclusions based on projections of CE business models, assessed by linear assessment methods.

Within the established accounting structures, definitions for value and risk have also evolved over the years, which has been illustrated in chapter 4. Within these structures, the focus is only on financial value. Ecological value - represented in CO2 or raw materials - has no place in these systems and thus cannot be assessed in conjunction with financial value or risks. Also, the risks assessed within these frameworks often have no climate risks or commodity risks. After all, commodities have been sufficiently available in the past centuries, and climate risks were not reflected in pricing structures and could not be attributed to individual companies. For shaping the circular economy, precisely these elements are important to make different choices.

In recent years, to form the structures and vision of risk and value, historical data has been collected to underpin our thoughts and structures. This provides guidance and assurance that we can draw conclusions from these structures. They have the linear principles of take-make-waste. Sustainable development

aims to provide future generations with sufficient resources to meet their needs. We want to build future-proof structures, based on the principles of longevity and reuse. We do this based on the view that there are risks with regard to climate change and resource scarcity. But there are no historical figures for these risks and they are therefore difficult to quantify. Because of the lack of data, which would help to balance the risk-averse attitude of accountants and financiers, the decision-making field lacks the support of and access to cash flows. It is unclear what the conditions are for a circular business model to obtain financing.

The financiers who currently focus on CE business models are often not or less bound by structures and can act on the basis of their own vision. This occurs in the form of new funds, for example, or funds that have been allocated to take a higher risk. The timelines have been left longer or even open, so that the right time to sell an investment in the future can be decided, when it suits the development of the CE business model and the organization. The current developments of guidelines such as Corporate Sustainability Reporting Directive (CSRSD) and EU Taxonomy for the European context will help to increase and enrich the quantitative information available, allowing structures to be set up for financial institutions under supervision.

In chapter 5 a framework is presented to support L-CE decision-making in a qualitative way. The organizations, interviewed as part of this study, shared how their stakeholders want to be included step-by-step in increasing knowledge and thus building skills and reducing risks in order to implement large-scale changes to the core business. Knowledge must be built within an organization in order to gain support for bringing new concepts to the market, but also in collaboration with its customers. Furthermore, internal support must be obtained for the acceptance of new concepts.

6.3 ANALYSING MISSING ACCOUNTING ELEMENTS WITH A METAPHOR OF MUSIC

Based on the insights of the previous chapters, we can conclude that inter-organizational collaboration is important, where current accounting structures are not able to sufficiently capture the specific elements of value and risk that CE businesses aim to contribute. In the following paragraphs, the missing

elements are being analysed based on the inter-individual structures in a metaphorical context of music.

6.3.1 Risks

In today's economy, linear risks such as climate risks and resource risks are not separately identified, even though they exist. Meanwhile, we understand the (possible) effects of climate risks and commodity scarcity is also becoming visible, including from externalities such as the war in Ukraine. This way of looking at risk has become part of decision-making, which is facilitated by accounting structures such as balance sheet and P&L set-up and ratios like profitability or return on investment. For companies in transition to a circular economy, one reason for doing so is precisely to reduce these risks like climate and resource scarcity. If these risks are not visible in current decision-making, the added value of this different way of working will also not be clear to decision-makers without additional information. And without additional information, for decision-makers, whether internal stakeholders or external stakeholders such as financiers or shareholders, the return question common in the current structure will remain in force. This is often focused (generalised) on through short-term financial returns. The short-term focus prevents acting from a broader vision, in which current developments such as climate developments and resource scarcity become more visible on the one hand, and longer-term vision, in which climate risks and resource risks are predictable on the other hand. Building a CE, which focuses on other ways of working together, other principles of business models and other principles of design, creates uncertainty and is therefore seen as high risk compared to the usual way of working in the linear economy.

6.3.2 Values

The multiple values (ecological, economic, social) of the CE is currently not sufficiently seen and mainly translated into current decision-making frameworks - based on accounting structures - of mainly one-dimensional economic value. One could say that by not including the current ecological damage, the bill is being passed on to the future, where it will still be presented. Not only should we not want to pass on the damage of our actions to the future, but we should also make overdue investments from the damage we have caused in our linear economy to change the way we

work. By leaving accounting frameworks unchanged, externalities (damage to the environment, for which we will be presented the bill in the future) would not factor into decision-making. This argues for a change in accounting frameworks, incorporating social, environmental and economic components as well as restoration of nature. From this perspective, risk and value are two sides of the same coin, balancing with each other. By not seeing the risks of the current way of working in the linear economy, the additional value of the circular economy is not appreciated. In the framework as presented in chapter 5, therefore the balancing act between risk and value/benefits are described as *impact*.

6.3.3 New accounting guidelines

This argues for setting up accounting frameworks, which provide a broader picture of risks in an objective manner and with today's insights. This fulfils the need to add environmental and social values to the insight of business cases presented, in which the CE will be shaped. The accounting structures must therefore, on the one hand, flesh out the risks we do not currently factor in in today's linear economy and, on the other hand, make the CE value visible.

The value of the circular economy is often mainly linked to CO2 reduction and the reduction of use of new raw materials. These are the ecological values of the circular economy. To achieve this, social values are also important, which often remain underexposed (Kuzma et al., 2022). Looking at the value of the circular economy from the tragedy of the common (Hardin & Baden, 1977), the value of the circular economy is the joint focus of market players on the common good. To shape a CE, there must be alignment in the chain, within which one's own added value and business model are redefined. We saw this with the example in the illustrative case study in chapter 5, an entrepreneur setting up recycling for a sector, seeking to find a sector solution rather than a local or product-related one. He asked the pilot project participants to put the common goal first and engage in the project on that basis. How this is structurally translated into other business models and incentives is the next step. This new way of working together is still underexposed in its added value, perhaps prerequisite for shaping the circular economy. From an accounting perspective for organizations in L-CE transitions, though, it is an important element, because it is about a different form of control over their

organization. Maintaining control, and thus reducing risk, is a key element for L-CE transitions. As mentioned in chapter 5 by one of the interviewees: "If we grasp, understand and can manage risks, then we are quite willing to take the risks. But we don't go about it in a rush". Part of the value (and risk) of CE business models is the alignment in collaboration with supply chain partners. To understand what elements of control are needed on the element of collaboration in the CE, we can make the parallel to a collaborative form, in which the common goal is central, music.

The following section includes an illustrative metaphor to represent this mismatch in cooperation.

Imagine you are going to a concert of a famous orchestra in a beautiful concert hall. You have been looking forward to an evening with beautiful music in a beautiful ambiance. It is 8.15 pm, you are in your designated place in the hall and the conductor enters. After loud applause from the audience, it becomes quiet. The conductor begins to move his baton and the musicians begin to play. After the first sounds you still think it's a mistake .. but the musicians keep playing. Everyone plays their own partiture, it's not harmonious, different musicians play in a different key and by the way, do they play the same piece of music?
This is how companies with a circular business model should feel at the moment in a playing field in which they play but have changed their key from B to C(ircular). It no longer sounds harmonious, it no longer tunes into the structures of the other musicians who still have the score in the original key. The conductor who has to bring the orchestra together looks seriously at it and stiffly beats the beat.
When we look at companies that strive for CE, they are perceived by the other companies as playing 'the wrong key´, because the linearly oriented companies play whatever the masses play. That is how it is judged by the public, or in the case of business, by the accountants and financiers. They assess the performance of companies on the basis of the old standard. It is seen as a risk, as a dissonance to choose a different view for your company, the other values are not seen and not appreciated.

We can learn from forms of collaboration in music if, as in the circular economy, we aim to focus on the common goal. A number of control elements define the setup, which we should furnish as social elements of control to accounting structures for L-CE transitions.

TABLE 7: comparison between music and CE

	Element in collaboration within musical settings	*Translation into accounting structures for L-CE transitions*
Coordination and accountability	Every player knows what music they need to play from their sheet music. The conductor interprets the music according to the optimization of the composition and makes musicians accountable for their own part.	All players in a sector have a role to play. From a central coordinating role, responsibilities can be designed.
Overall plan / composition	Musicians work from a central plan (composition), in which they play their part and which is worked into the overall configuration	A common frame of reference from national objectives, translated into sector plans and into one's own strategy is essential to jointly arrive at the optimal common goal.
Clear method of commitment / language	The agreements the parties have to abide by are laid down in a form that everyone can understand (sheet music), so that everyone - even from different backgrounds - knows what is expected of them.	The various levels of plans should be displayed in a way so that everyone can make their own translation in a combined quantitative and qualitative form.
Rhythm	The tempo of the performance of a composition is determined by the skill of the musicians. The conductor should expect effort to be able to play the notes, but within the context of what is achievable.	In the joint plans, the rhythm should be aligned in a way that is feasible but requires effort.
Frequency	Musicians tune their instrument at the start of a performance to maximise a harmonic performance, for example at 440 or 442 Hz.	This alignment between musicians, could be translated into the strategic orientation, the alignment between market players what the values and intentions are to achieve the higher goal of a sustainable value chain.
Principles of nature	To play harmonic music, the principles of nature are central. In music, this is the workings of sound waves and how they interfere to form a whole.	The principles of nature are also central to the CE. Achieve a balance between ecological, economic and social values, in which nature can recover. A predominance of one of these values does others injustice, creating adverse effects. Balance is the key word.

We are finding new structures to play the same in the same key signature as the CE businesses do and we are developing a pathway for the intermediate time that both linear and CE business are being combined in the economy. These accounting structures require the balancing act between ecological, economic and social values.

6.4 ANSWERING THE RESEARCH QUESTION

In this section, the sub-questions and the central research question will be answered, based on the conclusions and analysis in previous paragraphs.

The following sub-questions were formulated:

1. *What are the strategic and tactical approaches of organizations on the circular economy pathway of decision-making?*

Strategic and tactical development paths in L-CE transitions proceed both within an organization and between organizations. Current power structures need to be replaced by trust in an uncertain time, with a holistic vision focused on long-term retention.

2. *What is the current perspective of financiers and accountants on (the value of) circular business models?*

Financiers and accountants translate reality into accounting structures, which are the basis for decision-making. Current accounting structures do not adequately reflect current climate and resource risks, on the one hand, and only financial value without being able to balance environmental and social values in them, on the other. Moreover, additional data on future changes is hardly available and only with great uncertainty, while a risk-averse attitude predominates in accounting structures.

3. *What are the financial and management accounting frictions to overcome transition from linear to CE?*

The climate and resource risks not included in linear accounting structures must be made explicit and the elements of value (ecological, social) that build a circular economy must be able to be represented.

4. *How can linear-circular transitions be supported in decision-making by information to reflect the value and the risks of the circular economy?*

Data is only available to a limited extent, but within strategic decision-making it is important to bring stakeholders to the same level of knowledge and to make risks and value transparent from a shared vision. Therefore, new accounting structures can support this, where elements of value and risk are made transparent from qualitative foundations - if quantitative data are not available or of insufficient quality. These new accounting structures should explain to decision-makers what is different about a circular economy and the elements that contribute to its successful implementation.

This leads to the answer of the central research question "*How can strategic decision-making in linear-circular economy transitions be facilitated to overcome the accounting and financial hurdles in terms of providing information on both risk and value?".*

Strategic decision-making needs to be supported by new accounting structures that reflect value and risk of the circular economy in a way, which also reveals the current underexposed values of the linear economy. Shaping accounting structures in which social, economic and environmental values are all reflected, as much as possible in quantitative and otherwise in qualitative ways, creates a playing field of comparability and transparency. This playing field creates a basis in which shareholders, financial institutions and investors also have something to hold on to and digitalisation can support decision-making.

6.5 CONTRIBUTION THESIS

This section describes the contribution of the thesis based on the existing literature and the academic and practical gaps that have been identified. The contribution can be divided into three main items, which will be explained accordingly in separate paragraphs.

1. The perceptions of risk and value have to be reframed and decision-makers need to be educated to support strategic decision-making processes.

2. A language gap exists between fields of expertise that are creating the CE.

3. Accounting tools will be necessary to support decision-making for both intra and inter-organizational decision-making.

6.5.1 Re-framing / education for perceptions of risk and value

In recent years, various literature has been published on the economic performance of companies focusing on sustainability, mainly referred to in the financial and investors context as environmental, social and governance (ESG) activities. The common thread in this literature is the proven correlation between positive economic impact and sustainable activities. Nevertheless, it is difficult for companies to get the circular economy started. Many companies focus mainly on economic performance, as it is difficult to value the exact effect of environmental or social activities. When we observe how CE transitions are started, we see that this is from the perspective of reducing waste and increasing material efficiency (in Europe, Japan and US) and in China from the perspective of top-down implementing governmental policies towards net zero (Ghisellini, Cialani, & Ulgiati, 2016). Since L-CE transitions contain complex interrelationships within supply chains, multidisciplinary collaboration at all levels as well as education is important to be successful. In this multi-disciplinary collaboration, the role of accounting professionals is to ensure that the value of CE is translated correctly (Nadeem et al, 2018, p.50). Accounting professionals have an important role in supporting decision-making and reflecting the outcomes into future scenario projections of the organization. Dynamic capabilities of employees within organizations towards L-CE transitions positively influence the results (Scarpellini et al., 2020). These capabilities reflect environmental accounting and show a positive effect towards Corporate Social Responsibility performance or organizations in both financial and ecological performance. In making more CE based choices, Peralta et al. (2020) described the lack of knowledge and information to support decisions. These authors suggest to further promote CE strategies, support information exchange between supply chain partners and incentivize the industry to innovate according to CE principles.

This thesis provides a rationale to the aspects of value and risk and how they can be misguiding without additional information explaining the environmental and social risks and value. On the one hand, accounting professionals need to be trained to understand CE principles and how they relate to value and risk and, on the other hand, decision-makers need to interpret them correctly and place them in the holistic context of transitions. Nadeem et al (2018, p.50) suggest information and knowledge building for the accounting professionals´ education within accounting and finance degrees.

Several recent publications highlight the positive connection between Environment, Social and Governance (ESG) more broadly or CE and economic performance more specifically. Although CE requires higher investments and involves higher risks, the efforts of implementing CE principles into supply chains can lead to higher financial performance. Some examples follow to illustrate this development. According to research in 460 Mexican automotive related companies, the benefits besides the financial performance are increasing operational efficiency and stronger supply chain management systems (Rodríguez-González et al., 2022). Implementing CE principles also shows improvement of financial performance in another context, approached from the innovation method that has been applied. Research into 31 Malaysian public listed companies shows that implementing eco-innovation practices – which can be seen as CE principles– has a positive correlation with financial performance of the companies (Johl & Toha, 2021). A positive relation between CE information disclosure and financial performance is also indicated by researchers investigating Thai listed companies between 2016 and 2019 (Naksomsong, 2021). Researchers emphasize the complexity in supply chains, changed collaboration and the alignment between stakeholders within the supply chains to successfully implement CE.

Although CE seems to emphasize environmental aspects of sustainability, social aspects do have an influence on L-CE transitions. As shown by research from Ghana, where implementing reduce, re-use and recycle policies were investigated within manufacturing, distribution and consumption processes, the financial performance improved correspondingly. The supportive role of culture in adopting these policies in increasing financial performance was mentioned as one of the important aspects in L-CE transitions (Kwarteng

et al., 2022). With a supportive culture, innovation can be facilitated in an organizational context where environmental and innovation performance are supported, which has a positive impact on financial performance, according to research of 308 manufacturers in China (Yu et al., 2022).

Although at the macro level the positive correlation between economic performance and CE implementation are visible, at an organizational level it is difficult to make this value concrete and explain it for one's own organization. In this thesis, suggestions have been made to facilitate the process of decision-making.

6.5.2 Bridging a language gap between fields of expertise

Several indicators have been developed to provide insights into the additional value or risks of CE. In particular, indicators focus on the environmental aspects of the circular economy in reducing waste, measuring inflows and outflows or reducing carbon emissions. CE can only be achieved from a long term perspective. Although the economic effects will be measurable, the level of uncertainty of the actual developments in the coming years is high. Since changes in collaboration and control will occur, a considerable number of stakeholders will be losing control (Di Vaio et al., 2022). Understanding the differences in ways of working in relation to other supply chain partners in current linear versus future CE is important to control the risks.

Cayzer et al., (2017) described the limitations of quantitative indicators and the superficial connection of these into decision-making processes. From an extensive literature review, Kuzma et al., (2022) indicate that the social dimensions lack in CE indicators and that there is a dominance of environmental indicators, supporting CE transitions. Since development of these indicators is rather new, the authors suggest further development of reliability and validity of the used data. In inter-organizational connectedness, literature review has been performed on CE indicators for CE supply chains (Calzolari et al., 2022), where authors describe the lack of holistic CE indicators. Most indicators focus on the firm-level. Additionally, they describe that the economic dimension in transitions is emphasized, but current CE indicators have sometimes hidden assumptions on the value of CE. In categorizing the different CE indicators, monitoring the effects of CE, Saidani, et al (2019)

suggest a taxonomy to select the right indicator on meso, micro or macro level, CE loops or CE performance from the perspective of different user requirements. In analyses of L-CE transitions, the interconnectedness of organizations often lacks as a perspective (Reike, Hekkert, & Negro, 2022), thereby missing important aspects to influence and accelerate L-CE transitions. Regulations may incentivize or drive industry into innovation such as extended producer responsibility, where producers have to take responsibility over the resources and products.

L-CE transitions are complex, where collaboration at different levels and between different groups of stakeholders is essential, but expectations and understanding differs between groups of stakeholders with a diversity of expertise. In a research project involving stakeholder groups consisting of researchers, administrators and economists the different groups expect different contributions from CE (Kevin van Langen et al., 2021). The three groups in this research shared a joint CE vision, but the researchers emphasize a holistic approach of transitions, while administrators and economists expect a more bottom up approach from the industry. The contributions from L-CE transitions are different according to the different stakeholder groups in this research, where administrators expect a contribution to economic growth and job creation and the other two groups mostly expect environmental benefits. Researchers also expect the transitions to be more costly to consumers and industry, which requires support in decision-making, in addition to the government´s role to incentivize and support the image of CE strategies. Since there is limited experience in L-CE transitions, but the holistic approach supports successful transitions, it is important to express these expectations and assumptions to align and discuss them to support more objective decision-making.

Understanding the value and risk of CE will support illustrating the changes in financial performance of CE principle-based strategies, since they will be different from linear economy business strategies. The specific barriers companies face by adopting CE related to financial performance are (1) size of the business and initial cost, (2) difficulties for micro and small companies, (3) a more complex business structure and (4) greater exposure to risk, due to the novelty of the concepts and differences compared to the linear

standards (Gonçalves, de Carvalho, & Fiorini, 2022). A holistic view of the overall transition and connecting it to supply chain partners and developing it together is necessary to successfully overcome the financial barriers. Some aspects of implementing CE principles can be related to cost savings, such as resources regeneration, sharing products and services, increasing resources productivities and focus on the circular flow of materials (Sarfraz et al., 2022), but overall investments are needed to change operations within organizations and supply chains.

In decision-making processes for senior managers, adopting CE strategies into their businesses, the expectation of exceeding the initial investments into long term financial benefits is important. This consideration may be affected by shareholders´ expectations that sustainable and circular strategies are implemented with related financial returns, since the weighted cost of capital is negatively affected by implementing CE principles (Sarfraz et al., 2022).

This thesis contributes to the academic field to understand the different values and risks both from a linear and CE context. Since CE development is complex, it requires a combination of areas of expertise to properly understand and articulate this value and risk. In the absence of complete indicators that emphasise this value, in conjunction with sustainability experts and accounting specialists, complemented by other areas of expertise, this value should be examined and discussed within decision-making processes.

6.5.3 Accounting tools for L-CE transition decision-making

Since accounting can be seen as the language of business, CE business strategies should be supported by the right language as well. Current CE indicators are not sufficient to support the holistic view on economic, ecological and social values and risks. Other accounting structures to support decision-making are lacking. It is recognized that supporting these transitions providing the right information in decision-making is a challenge (Dewick et al., 2020).

Since CE requires upfront economic investments, accounting should express value and risk to external shareholders, investors and financial institutions. CE indicators or other clear accounting structures would support the

highly regulated and digital environment of those financial institutions or professional investors (Kräussl et al., 2022). The roles digital infrastructures can play to support financial institutions are: (1) gather data about supply chain operations and address performance via a bottom up micro view and (2) help regulators monitor financial institution activities to invest in these companies and supply chains at a top down and macro view level. The lack of current CE accounting structures forces current financial stakeholders to make judgements based on limited information and gives room for personal opinion, which is often risk-averse. In the complexity of L-CE transitions, big data in particular could play an important role in reducing risks and identifying patterns in success factors. The use of big data would support CE decision-making in a positive way, according to company CE performance. Big data improves company decision-making quality and this supports L-CE transitions. The current context for financial stakeholders, though, is that L-CE transitions are complex, data availability is limited and often future oriented with a high level of uncertainty (Awan et al., 2021).

Current CE indicators lack a holistic perspective of the L-CE transition (Calzolari et al., 2022) and social aspects (Kuzma et al., 2022), since ecological and economic aspects are emphasized. This is despite the fact that a positive financial performance due to sustainable activities by companies was researched and proven to be positively connected. Disclosure in external reports of their Environmental, Social and Governance (ESG) activities has a positive influence on a company´s reputation, which creates investor confidence, efficient use of resources and competitive advantage (Tarmuji, Maelah, & Tarmuji, 2016). In the separate items of Environment, Social and Governance, differences of appreciation by financial experts can be recognized. The social factor has a significant impact on the credit rating for example, while the environmental factor has a negative effect on credit rating (Kim & Li, 2021). Overall the ESG disclosure is appreciated by financial experts in investment management, but the effect may differ per sector or firm size (Lagasio & Cucari, 2019). Despite the appreciation from financial investors, the current lack of accounting structures to support more objectively decision-making and therefore create a more transparent process to access funding for CE investments, is an important gap in efforts by government, business and financial institutions to accelerate towards the circular economy.

This thesis has contributed to understanding the misinterpretation in L-CE transitions of value and risk. By introducing a framework in Chapter 5 on how to qualitatively represent risks and values on the various dimensions of CE, a start is made to underpin this with more quantitative elements and thus enable more objective decision-making. Social aspects, especially with regard to inter-organizational cooperation, are also essential to get a more holistic picture of the success factors of the circular economy.

6.6 LIMITATIONS OF RESEARCH

In this research, the aim was to provide insights into the financial and accounting hurdles within strategic decision-making. The following limitations of this research can be identified.

Netherlands as main research area

Most research projects were conducted in The Netherlands. Due to the fact that The Netherlands is identified as a front-runner in CE development, this country has a specific context. In chapter 5, part of the cases were researched in Australia to explore the wider applicability of the concepts, but further geographical exploration of the concepts is preferable.

Construction sector

In The Netherlands the government is an accelerator of CE development in the nation as a major customer demanding businesses for CE concepts, materials and innovations. Although the construction sector can make a large contribution to carbon reduction as a high-resource intensive sector, the conclusions that are drawn from the construction sector may not be applicable to other sectors in linear-CE transitions. Other sectors should be researched to validate the conclusions from this research to other sectors.

As-a-service models

In multiple research projects, the as-a-service model was the CE business strategy that prevailed in implementing CE principles into the core business. This CE strategy is rather close to the current selling model, replaced by other cash flows, customer commitments and implementing sometimes rather small additional sustainable advantages. In creating a closed-loop CE supply chain,

more complex steps will be necessary in close collaboration with the supply chain.

Linear-CE transition in early stage
Development of CE is still in a very early stage, even in The Netherlands. The complex international supply chains, strong structures and current influential powers increase the risk factors and make it difficult to change and still be in (linear) business during the process. When more examples of CE business models are being developed, accounting or financial hurdles may change because of additional data being available, which may change risk perception of financiers and accountants.

6.7 SUGGESTIONS FOR FUTURE RESEARCH

The field of L-CE transitions is rather new in designing the structure and principles as well as identifying which hurdles still need to be overcome. In academic literature, academic papers on CE have increased immensely. The accounting perspective in developing CE is highly underdeveloped, where this thesis aims to contribute in understanding the tensions between the current accounting structures in CE business models. In chapter 5 a framework was introduced to support building new accounting structures that can be supportive to L-CE transitions. Since this framework has been constructed based on literature review and a limited number of cases and expert opinions, additional research should be undertaken to develop this tool further and other tools for decision support in these L-CE transitions.

The development pathways in order to structure decision-making were based on a limited number of companies in a specific context. To know more about designing development pathways and connecting business in supply chain CE collaborations, further research would be preferable.

In supporting information to linear-CE transitions, a framework to support the decision-making process has been developed and presented in chapter 5. To be able to support the accounting field, the toolset of frameworks, tools, ratios and other structures should be extended to an integrated set where economic and ecological values can be adequately reflected.

The concept of value and risk is mentioned combined with the future developments of climate change and raw material risk. The lack of valuation techniques where valuations can be based on assumptions to calculate these hinders current accountants and financiers to make decisions. In future research, a commonly accepted set of standards, assumptions and scenarios can be developed to calculate this future value of materials based on the same standards.

In economic and business education, financial values prevail in supporting decision-making. Educational programs should include sustainability principles and the relevant tools and frameworks in order to develop a clear vision of the common goal of the sustainable way of working that is aimed for. This can then be translated into the financial or board level field. This knowledge has to be created and included in the educational fields.

Current financial decision-making is based on many guidelines, structures and templates. To reframe all these rules would be impossible and probably not necessary. Principle-based guidelines will support faster application and in different contexts. This will be more difficult for accountants to assess and disclose but it invites a discussion and for it to be expressed in the right text or figures. Creating those principle-based guidelines, will need development in further research to find matching auditing tools to create the intended transparency when we do not have the strict ratios that we are used to in the current linear economy.

EXECUTIVE SUMMARY

Only by reducing energy and replacing fossil fuel based energy by renewable energy, would we be able to reduce carbon emissions worldwide by 55% (Ellen MacArthur Foundation, 2020). The additional 45% to achieve the zero carbon ambition can be achieved by implementing the circular economy (CE) (Ellen MacArthur Foundation, 2020). Circular economy (CE) in this thesis is defined as re-using materials, reducing waste and restoring nature (Ellen MacArthur Foundation, 2015). In the current linear economy, we assume materials are infinite, where financial resources are scarce. In building a circular economy, both ecological resources (carbon, materials) and social values should be included in choices based on scarcity (Jorgensen & Tynes Pedersen, 2019).

In educational textbooks accounting is presented as "the language of business". The parallel to a language can be seen as a way to communicate, selecting words and following regulations (grammar) and building sentences (structures) to exchange information (Bloomfield, 2008). Financial stakeholders interpret this information on which they may base their decision-making.

This thesis answers the research question "*How can strategic decision-making in linear-circular economy transitions be facilitated to overcome the accounting and financial hurdles in terms of providing information on both risk and value?"* To answer this question and the related sub questions, case study research, focus group research and design science research have examined the playing field of accounting and finance in various studies.

In case study research (chapter 2), the strategic development pathways of the organizations in Linear-Circular Economy (L-CE) transitions have been explored, resulting in the insights that investments for CE and benefits could relate to other market actors in the value chain. Production organizations need security that the market will need the CE products and materials, but clients (end of value chain) need to ask different questions and assume other supply chain partners as equal. Strategic development requires both internal and external development pathways to be successful in implementing CE principles.

In chapter 3 real-life cases were discussed in several focus group expert meetings of accounting, legal and financial institutions, to explore the accounting and financing hurdles, hindering the cases to be successfully adopted. In this position paper the basic accounting instruments were explained for a non-financial audience, to bridge the gap between different fields of expertise. Illustrated by a product-as-a-service case, the accounting ratios and changes in profit and loss statement and balance sheet were presented. Based on the cases and the expert discussions it can be inferred that, under the current linear accounting principles, conclusions will be drawn that conflict with the long term aim of resource control and long term profitability. These specific elements identify the combined economic-ecological value of CE business cases, which cannot be assessed with the current accounting tools to draw the right conclusions that reflect that additional (long-term) value.

In chapter 4, two of the cases from focus group meetings from the construction sector are further explored, to detail the accounting hurdles that hinder decision- making. The timeframes conflict with the goals of longevity and durability of products. The upfront higher investments to redesign products and services will have a longer payback period. This conflicts with the linear short-term profitability ambitions of most financial decision makers. The additional value cannot be included in the current economically focused accounting structures and ratios and also climate change risks and materials risks are not visible in the current (linear) accounting structures.

Chapter 5 therefore illustrates a framework, which is designed based on the literature review, additionally refined by real-life cases from Australia and The Netherlands and validated by experts in the field of accounting, investors and academic institutions combined with CE. The framework presents a qualitative information structure to describe the risks and benefits of a L-CE business case for strategic and financially oriented decision makers.

The research question of "*How can strategic decision-making in linear-circular economy transitions be facilitated to overcome the accounting and financial hurdles in terms of providing information on both risk and value?",* can be answered by implementing additional accounting structures, and additional elements of

values and risk (ecological, economic and social) should be presented in an objective manner. Currently, the focus is on ecological values within the circular economy - CO2 emissions and reuse of raw materials. But social values can be identified as the changed cooperation needed to achieve the common goal. The elements of structure that we can set up for this in accounting structures have been identified using the metaphor of music. There, working together to achieve the common goal is central. In order to work together well, the same pace of change (rhythm), the same strategic conception (frequency), language laid down in a clear way (score), common plan (composition) and coordination and accountability (conductor) are important.

We envision the L-CE transition as a new play, tuning in to each other, but we are still rehearsing. We cannot yet expect the same perfect products and organization that we have developed over time for linear products. It takes time, but structuring the benefits and value will certainly help to bring harmony into the economic system.

SAMENVATTING

Wanneer enkel de energietransitie (reductie van energie en vervanging van fossiele energie naar hernieuwbare energie) ingezet zou worden om de huidige CO2 emissies te reduceren tot 0 in 2050, dan zou enkel 55% van de CO2 emissies gereduceerd kunnen worden (Ellen MacArthur Foundation, 2020). De additionele 45% om de zero carbon ambitie te bereiken kan worden bereikt door de circulaire economie (CE) te implementeren (Ellen MacArthur Foundation, 2020). De circulaire economie (CE) wordt in dit proefschrift gedefinieerd als *hergebruik van materialen, vermindering van afval en herstel van de natuur* (Ellen MacArthur Foundation, 2015). Dit positioneren we als de tegenhanger van de huidige lineaire economie, waarin we ervan uit gaan dat materialen oneindig zijn (gezien de hoeveelheid afval) en waar (enkel) financiële middelen schaars zijn. Voor het bouwen van een circulaire economie is juist een belangrijk uitgangspunt dat ook de schaarste van ecologische hulpbronnen (koolstof, materialen) en beoordeling van sociale waarden worden meegenomen (Jorgensen & Tynes Pedersen, 2019).

In literatuur wordt accounting gepresenteerd als "de taal van het bedrijfsleven". De parallel met een taal kan worden gezien als een manier om te communiceren, het selecteren van woorden en het volgen van voorschriften (grammatica) en het opbouwen van zinnen (structuren) om informatie uit te wisselen (Bloomfield, 2008). Financiële belanghebbenden interpreteren deze informatie waarop zij hun besluitvorming kunnen baseren.

Dit proefschrift beantwoordt de onderzoeksvraag *"Hoe kan strategische besluitvorming in transities van lineaire naar circulaire economie worden vergemakkelijkt om de accounting en financiële hindernissen te overwinnen wat betreft het verstrekken van informatie over zowel risico als waarde*?". Om deze vraag en de daaraan gerelateerde deelvragen te beantwoorden is in verschillende studies zoals casestudieonderzoek, focusgroep onderzoek en design science onderzoek het speelveld van accounting en financiën onderzocht binnen besluitvorming van organisaties.

In case study onderzoek (hoofdstuk twee) zijn de strategische ontwikkelingspaden van de organisaties in Lineair-Circulaire Economie (L-CE) transities verkend, resulterend in de inzichten dat zowel interne ontwikkeling

van organisaties en externe ontwikkeling (tussen organisaties) van belang is voor het vormgeven van een CE. Productieorganisaties hebben zekerheid nodig dat de markt de CE producten en materialen nodig zal hebben, maar klanten (eind van de waardeketen) moeten zich anders verhouden en andere ketenpartners als gelijkwaardig beschouwen om tot vertrouwen en succesvolle samenwerking te komen.

In hoofdstuk drie werden praktijkgevallen besproken door verschillende focusgroep bijeenkomsten van deskundigen op het gebied van accounting, juridische en financiële instellingen, om de hindernissen op het gebied van accounting en financiering te onderzoeken die een succesvolle invoering van CE bij bedrijven in de weg staan. In deze position paper werden de basisinstrumenten voor financiële verslaglegging toegelicht voor een niet-financieel publiek, om de kloof tussen de verschillende vakgebieden te overbruggen. Aan de hand van een product-als-dienst casus werden de accounting ratio's en veranderingen in de winst- en verliesrekening en de balans gepresenteerd. Op basis van de cases en de discussies met deskundigen kan worden afgeleid dat bij de huidige lineaire accountingbeginselen verkeerde conclusies worden getrokken. De lineaire structuren hebben andere principes, die in strijd zijn met de lange termijn doelstelling en behoud van grondstoffen waar CE op gebaseerd is. Deze specifieke elementen identificeren de gecombineerde economisch-ecologische waarde van CE-bedrijfszaken, die met de huidige accounting instrumenten niet kan worden beoordeeld om de juiste conclusies te trekken die die extra (lange termijn) waarde weerspiegelen.

In hoofdstuk vier worden twee van de cases van de focusgroep bijeenkomsten uit de bouwsector verder uitgediept, om de accounting hindernissen die de besluitvorming belemmeren in detail te beschrijven. De huidige structuren beperken de inzichten en voordelen van de CE als de langere levensduur en hergebruik van materialen. De hogere initiële investeringen om producten en diensten te herontwerpen hebben een langere terugverdientijd. Dit is in strijd met de lineaire korte termijn winstgevendheidsambities van de meeste financiële besluitvormers. De extra waarde kan niet worden opgenomen in de huidige economisch gerichte accounting en ratio's en ook de risico's van klimaatverandering en materialen zijn niet zichtbaar in de huidige (lineaire) accounting structuren.

To stop climate change, we need to build a sustainable society with an economy where energy is generated sustainably and commodities can be reused.

A key role in creating this society is played by business, which must shift away from short-term profit and shareholder value to long-term continuity and stakeholder value. This book describes this new way of collaborating as the circular economy, in which products are being designed for long-term use, easily repaired and using recyclable materials. Restructuring the economy requires different business choices that underpin this sustainable attitude, but this is by no means straightforward. For this, value creation and risk management need to be redefined, which cannot yet be expressed in accounting frameworks, resulting in a lack of structure underneath this new thinking. The challenges posed by this playing field are explored.

Diane Zandee links her business, sustainability and financial background in this research to understand the barriers to achieving sustainable decisions and a circular economy. As a consultant, she guides companies in their sustainability efforts and as a university lecturer, she teaches on this topic.

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