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ESE-BPA: An integrated qualitative process analysis framework

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1 Introduction

Business process management is explained as a holistic management concept [23,41,94]. It stresses the relevance of looking at the relations between activities, people, and technology to deliver products and services. The collection of tasks and activities that are structured to provide a service or product is a business process [95]. Analyzing these business processes can be done both quantitatively and qualitatively. Quantitative process analysis looks at processes in terms of performance and efficiency, whereas qualitative process analysis allows for a systematic perspective. Examples of qualitative techniques for process analysis are value-added analysis and stakeholder analysis. Qualitative process analysis can be considered as supportive to quantitative process analysis. The results of qualitative process analysis may lead to suggestions for process redesign. The effects of process redesign, in turn, can be measured quantitatively.

Over the years, sustainability has become of increasing interest in business research and practice [64]. Organizations have developed an increased awareness on how their actions affect the planet and its inhabitants. An example on how this has developed in the field of information systems and business processes, is Green Business Process Management (Green BPM) [94]. When looking at the six core elements of BPM [83], literature regarding Green BPM is mostly focused on methods and IT, rather than the other four core elements of people, culture, strategic alignment and governance [59]. These include annotations on resource usage [34,45,46,79], how to use process performance management to enable corporate sustainability [16], and propose a three-dimensional research framework on Green BPM [73]. This part of literature focuses mostly on the sustainable and environmental side of business process management.

However, research shown on the organizational level has proven that it is possible to include other externalities next to environmental factors as well [37]. Environmental, social and ethical accounting (ESEA) methods, such as B Impact Assesment [108], Global Reporting Initiative [120] and Common Good Balance Matrix [110] are able to assess organizations in terms of their environmental, societal and ethical impact. As Green BPM is limited to the environmental externalities, it is not used to include the social and ethical externalities. As organizations are involved with multiple business processes, the societal and ethical impact could potentially originate from these processes. Contemporary business process analysis techniques have not taken this approach yet. Therefore, the aim of this thesis is to extend current (Green) BPM methods to include these factors as well.

The research question to this thesis is the following: *In which respect can individual business processes be analyzed in terms of environmental, social, and ethical externalities?* The answer to this question will be found by analyzing ESEA methods and integrate them into a process analysis framework. The contributions of this research are the following: (1) addressing the importance of having a broader scope to organizations and their business processes, (2) proposing a way for organizations to analyze their business processes using this broader scope, resulting in a more diverse set of qualitative process analysis methods, and (3) providing the academic forum with further research directions in this area.

1.1 Thesis Outline

This thesis is structured in the following manner. First, this thesis starts with an explanation regarding the methodology in chapter 2. In chapter 3, a theoretical framework is built to provide a foundation for this thesis. In chapter 4, different metrics for environmental, social and ethical business process analysis (ESE-BPA) are presented, while chapter 5 provides an overview of the envisioned integrated framework. Chapter 6 lists the different topics for the assessment, followed by the instructions in chapter 7. The thesis culminates in a conclusion in chapter 8 and a discussion in chapter 9.

2 Methodology

In this section, the methodology for this research is illustrated. It aims to provide an approach to the literature study, as well as to provide inclusion criteria for ESEA methods to be eligible for analysis and potential incorporation in an integrated qualitative business process analysis method.

2.1 Literature review

The literature review consists of two parts; (1) an academic literature dedicated to business processes, business process management, business process analysis, business process redesign, and ethics, and (2) a multivocal literature regarding ESEA methods. To retrieve relevant sources for the literature review, the searches were performed on the (scientific) databases of Google Search engine, Google Scholar, Microsoft Academic, Mendeley, Wiley IEEE, ScienceDirect and Springer. The inclusion criteria for the literature is included in Table 1. To extend the search and retrieve additional sources, bibliographies of the initially selected sources were reviewed and selected based on the mentioned inclusion criteria. The use of grey literature is included to support the multivocal literature [33]. The decision for both first and second tier literature is due to its credibility and the outlet control [4], which is considered to be worthwhile to this thesis.

Inclusion criterium	Academic literature review	Multivocal literature review
The sources were chosen based on their title, relevance, keywords, abstract, number of times cited or familiarity with the author(s) or organisations	✓	✓
The sources have to be written in or translated to English	✓	✓
The sources have to be peer-reviewed scientific contributions	✓	
The sources are either 'white literature', first tier grey literature or second tier grey literature [4]		✓

Table 1. Literature inclusion criteria

2.2 ESEA Selection Criteria

Within the department of Computer Science at Utrecht University, a literature repository regarding ESEA methods has been created[1]. In this repository, guidelines, flyers,

[1] Major contributors to this repository are dr. S. España Cubillo and V.D. Ramautar MSc.

and tutorials of over 50 ESEA methods are present. Of these methods, the following inclusion criteria are considered: An ESEA method is considered relevant when (1) it contains key performance indicators or metrics which are applicable individual business processes or (2) it contains suggestions for business process redesign. In addition, there are over 20 ESEA methods in this repository of which a Process Deliverable Diagram (PDD) has been created and internally verified. These PDDs assist in deriving metrics for an integrated framework.

Not all metrics from ESEA methods can be directly applied to all individual business processes. The extent to which human involvement is present within a business process may vary over different business processes. Therefore, metric selection criteria have been set. Metrics will need to be applicable to individual processes, e.g. it is able to be derived, calculated or assessed from the business process. In addition, analyzing these metrics should enable suggestions for business process redesign in the context of those metrics. The selected metrics are relevant for the stakeholders of the business process, where it can be noted that ESEA methods and business process analysis may involve different stakeholders.

An example is calculating the carbon footprint of an individual business process [79]. After calculation, an organization is able to identify where to take measurements in order to reduce the carbon footprint. Another calculable example is resource use, such as energy and water. A non-numerical example could be conflicts of interest of stakeholders involved in the process. Other metrics will follow in chapter 5.

3 Theoretical Framework

This section is dedicated to relevant literature to this subject. It consists of prior research in the field of business process analysis, and especially Green BPM. In addition, research regarding ESEA methods is presented.

3.1 Business Processes

There are many different definitions of business processes. It can be defined as a set of logically-related tasks performed to achieve a defined business outcome [19]. Another definition is a collection of tasks and activities (business operations and actions) consisting of employees, materials, machines, systems, and methods that are being structured in such a way as to design, create, and deliver a product or a service to the consumer [95]. Two important characteristics of processes is that it will result in a defined outcome for an internal or external customer, and that they cross organizational boundaries [19,23,95]. It is possible to illustrate business processes through diagrams, such as the Business Process Modeling Notation (BPMN) [101], Petri Nets [1], or Event-Driven Process Chains (EPCs) [52].

History of Buisiness Processes One of the first uses of something we can relate today as a business process is from the fifth century BC in the *The Art of War* by Sun Tzu (544 BC - 496 BC) [91]. Carrying out specific sets of tasks and activities, and assigning resources to the execution of these tasks and activities, he aims to complete certain objectives. Skipping forward about 2300 years, the Scottish philosopher and economist Adam Smith (1723-1790) wrote an analogy of the production of pins and its line of production in *An Inquiry into the Nature and Causes of the Wealth of Nations* [85]. A clear production line is split up into distinctive process steps, executed by different workers. This decomposition of work is also visible in the *Scientific management*-approach to organizations, also known as *Taylorism*. Frederick Winslow Taylor (1856-1915) observed that there were still various kinds of manual labor in the steel manufacturing industry. By decomposing the various activities, efficiency would increase [88]. He considered people to be machines which could also be manipulated and incentivized, and could also be rewarded in respect to their output [55].

These approaches to realizing goals, whether they are driven by warfare or commercial thought, are comparable to how business processes are perceived today. The product of an organization is the outcome of a number of activities performed [99]. A typical business process consists of events, activities and decision points and involves actors, physical objects and immaterial objects, and leads to one or several outcomes [23].

Business Process Management Business Process Management (BPM) can be considered as "supporting business processes using methods, techniques, and software to design, enact, control, and analyze operational processes involving humans, organizations, applications, documents and other sources of information" [2]. BPM consists of

six cores, which are (1) Strategic Alignment, (2) Governance, (3) Methods, (4) Information Technology, (5) People, and (6) Culture [83]. Strategic alignment can be considered as the linkage of organizational priorities and business processes. The goal is to enable continual and effective action to improve the performance of the organization. BPM governance is dedicated to the accountability for BPM. It includes roles and responsibilities, and is assigned with design of decision-making. Methods are the techniques and tools that enable and support activities of BPM. Examples are process modelling techniques, but also methods facilitating process enhancement such as re-sequencing. Information Technologies refers to software, hardware and information systems which enable and support process activities. These can be tools for analysis such as process simulation, but also systems which can derive process models from event logs. People comprises human resources. It looks at how people are educated and becoming knowledgeable about the process. Culture, the last core element, refers to the values and beliefs that shape process-related attitudes, as well as the behavior to improve business performance.

Business process management is a continuous effort. With each passing year, the present is becoming a less reliable guide for the past [40]. Innovation and improvement are ways for organizations to stand out and outperform their competitors. Management of processes is conducted through performance measurement for setting targets for improvement. Typically, it also includes measuring effectiveness, efficiency and capabilities of products, services and processes [104].

Business Process Analysis Business processes consist of a group of logically related tasks that use the resources of the organization to provide defined defined results in support of the organization's objectives [43]. Business process analysis aims at investigating properties of business processes that are neither obvious nor trivial [100]. Analysis is an overarching term, consisting of different aspects ranging from process simulation and verification to performance analysis. The analysis starts with understanding the process characteristics. Examples are efficiency and cycle time, which are prime targets for improvement in conventional process analysis.

Business process analysis serves to improve the business process. Improving a process means changing a process to make it more effective, efficient and adaptable. Harrington (1994) defined measurements for each category [43]. For effectiveness, he mentioned accuracy, timeliness, dependability and responsiveness. For efficiency, throughput, people utilization, computer utilization and cost reduction are measurements. Lastly, adaptability looks at special requests, using both absolute and relative data. The true value lies in being able to handle all sorts of different process instances.

These types of analysis are tangible, as they use quantitative metrics. These metrics clearly speak to mind, as their meaning is conclusive. In addition, there are non-quantitative ways of performing process analysis, which is a focal point of this Master's thesis.

Qualitative Process Analysis According to Dumas et al. (2013), there are multiple ways of performing qualitative process analysis. There are different principles and techniques which could lead to a good assessment. They mention value-added analysis, root

cause analysis, and issue documentation and impact assessment as approaches for qualitative business process analysis. These approaches are broad, and are not necessarily focused on specific topics of analysis.

Value-added analysis or value-added assessment can be used to identify unnecessary tasks within the business process. A large amount of resources in an organization are not dedicated to the value the customer wants to pay for [42]. Therefore, an organization should consider which tasks are essential. Value can be calculated, where the added value is equal to the value after processing minus the value before processing [43]. However, value is subjective and not necessarily to be addressed in terms of economic value. Within a process, three categories can be identified. These are real-value-added (RVA), business-value-added (BVA) and no-value-added (NVA)[23,42]. The difference between RVA and BVA is whether the process step directly results in perceived value for the customer, or whether it is necessary for the organization to run smoothly due to regulations or business characteristics. This may result in the elimination of certain steps in the business process, resulting in increased processing time, increased throughput, or decreased efforts, among others[24].

Root cause analysis is a family of techniques used to identify the root cause of undesirable situations. It is a tool not only designed to discover what and how an event has occurred, but also focuses on the why [82]. It is not used only in business process management, but also in the fields of product improvement [61] and healthcare and medicine [75]. Examples of different methods are cause-effect diagrams and why-why diagrams. Opponents of root cause analysis state that its flaw lie in its search for a single and linear cause, the diversity in quality of analysis [74]. Issue documentation and impact assessment are natural steps following a root cause analysis. After identifying issues, it is useful to identify the risk and the impact.

Business Process Redesign Business process redesign refers to the effort to augment organizational performance by improving effectiveness, efficiency, and adaptability of business processes [96]. The challenges in business process redesign can be divided into technical and socio-cultural challenges [80]. There are four dimensions in which the effects of redesign measures manifest themselves: time, cost, quality, and flexibility [12]. Improvements in one dimension can have a weakening effect on another, so the consequences should be carefully considered. Therefore, the interplay between these dimensions can be visualized into the so-called Devil's quadrangle [12,23,80].

The extent to which business process redesign is applicable differs per industry. There are more degrees of freedom for redesigning business processes in the service domain than, for example, the manufacturing domain [23]. This is due to the physical constraints manufacturing processes possess.

Discovering business process redesign opportunities can happen across different stages. In the planning phase, it can be useful to map out the process [11]. Business process redesign opportunities may also come to light as figments of an innovative and entrepreneurial mindset [63], or by the availability of new techniques [65]. As stated earlier, the consequences of acting on a business process redesign opportunity needs to be considered carefully.

3.2 Green BPM

The ecological impact of business processes can be analyzed through Green BPM. Conventional business process management focuses on the optimization of cost, quality, time, and flexibility of business processes, whereas green business process management additionally considers the environmental perspective and the trade-off between them [71]. In other words, Green BPM concerns the understanding, documenting, modeling, analyzing, simulating, executing and continuously changing of business processes with dedicated consideration paid to the environmental consequences of these business processes [84]. This can be done in various ways, such reducing the energy consumption and CO_2-footprint [13,45,79,89]. Research in Green BPM is mostly focused on process performance measurement and its trade-offs [35].

Green BPM consists of three dimensions: management activities, the stages of the process, and the goals of detecting or reducing emissions [73]. These dimensions are displayed in Figure 1. The management activities are based on the scientific method, first formulated by Francis Bacon (1561-1626) in *Novum Organum* [7], and the Deming cycle [21]. It consists of inductive reasoning, with formulating a hypothesis, testing it using an experiment and analyzing the data. With the results, one can further determine which actions to take. Carrying out green initiatives are usually focused on either reducing the impact on the environment or helping cultural change. Impact reduction is more explicit, since cultural change is more of a means to an end [44].

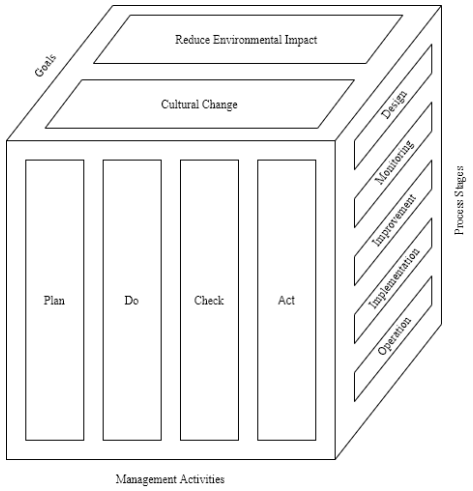

Fig. 1. Dimensions of Green BPM, from Opitz et al. (2014)

Green business process patterns describe solutions on how to design business processes in order to achieve certain business objectives which use environmental impact as an explicit design criterion [71]. Based on criteria, like the preference of customers, different versions of the same process can be provided [72]. An example is the packaging method of goods, for which non-plastics may be chosen whether or not an additional

fee is calculated. Metrics for classifying the *greenness* of IT systems are available [53]. There are four layers of green performance indicators (GPIs) to describe the energy consumption on different levels of an IT system.

The rising demand for organizations to address sustainability issues allowed for different tools to be developed. Even in the technological sector, there are methods and techniques to assess factors such as emission and resource use. However, it does not address business ethics and social well-being. In order to gain inspiration on how this can be achieved, we need to zoom out to the organizational level in order to grasp the bigger picture.

3.3 ESEA

The economy has been built to deliberately raise the well-being by production and trade of goods and services [86]. However, figures such as the NNP (Net national product) are not an index for overall well-being of a population. A growth in the formal economy may be accompanied by degradation in other fields. Environmental issues become present when the quality of the environment declines, by damaging ecosystems, resources becoming depleted or species becoming extinct. This is due to the environment and its resources being finite. These issues have been around for centuries. The first agricultural revolution, or Neolithic revolution, in the region of Mesopotamia resulted in accelerated deforestation in order to facilitate an agricultural society [90]. Over the years, more and more natural resources have been used to facilitate economic growth by increasing production. The industrial revolution tapped into the potential of fossil fuels. This, accompanied with the progress in medicine and sanitation, resulted in a population growth.

During this time, questions arose whether mankind sufficiently cares for the planet. Karl Marx (1818-1883) addressed the exploitation of nature's resources as "*Man lives from nature, i.e. nature is his body, and he must maintain a continuing dialogue with it if he is not to die. To say that man's physical and mental life is linked to nature simply means that nature is linked to itself, for man is a part of nature*" [31]. John Stuart Mill (1806-1873) envisioned a stationary state of economics, in which population and capital stock were not growing. Growth would become uneconomic: "*If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a happier or better population, I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it*" [67].

These are some examples of critique on the exploitative nature of conventional economics. In the field of accounting, these concerns can be illustrated through new trends. Accounting is the art of recording, classifying, and summarizing in a significant manner and in terms of money, transactions and events, which are, in part at least, of a financial character, and the results thereof [14]. Organizations are obliged by legislation to report on their activities. Starting in the end of the nineteenth century, the first organizations started reporting on social and environmental consequences of their business actions [39]. Modern social accounting is considered to be present from the 1970's, as different accounting associations started incorporating non-financial aspects of the organizations

accountability [37]. These aspects are now integrated into ethical, social and environmental accounting (ESEA) methods. ESEA is the process of assessing and reporting the non-financial impact of an organization's economic actions [26]. ESEA methods can be applied by organizations to assess their contemporary position in sustainability and business ethics topics [78].

ESEA methods There are various motives for organizations to apply ESEA methods [77]. Organizations might want to use the results for marketing purposes, identifying opportunities for improvement or account for the impact of actions after receiving funds from public organizations, among others. Noteable frameworks are the GRI Standards [120], the Common Good Balance Sheet [110], the ISO 26000 standard [122], the UN Global Compact principles [135] and the OECD Guidelines for Multination Enterprises, which are part of the Declaration on International Investment and Multinational Enterprises [125]. Applying ESEA methods is not regulated in a similar way as financial accounting. Although some countries require some form of sustainability reporting, it has not yet the status of financial reporting standards [38].

ESEA methods address certain aspects, but they differ in the extent to which these aspects are addressed [133]. For example, stakeholder engagement is reflected upon in the ISO26000 and the OECD guidelines, but is not part of the UN Global Compact principles. ESEA methods aim to stimulate responsible business practices. However, their means do slightly differ. The UN Global Compact is considered a learning platform, whereas the OECD Guidelines have a dispute settlement mechanism in order hold organizations to account [133].

Comparing organizations regarding their sustainability needs to be put into perspective [56]. The composite sustainable development index allows for comparing normalized values in the aspects of emissions, spills, environmental and safety fines, among other indicators. However, while no measure of sustainability is perfect, it can be useful for benchmarking and suggesting avenues for improvement [92].

3.4 Ethical Code

Organizations may implement a policy which maps out the company's principles, standards, and the moral and ethical expectations that employees and third parties are held to as they interact with the organization. This policy is referred to in literature as a code of conduct, ethical code, code of ethics, or ethical code of conduct. Codes followed an increased societal pressure by NGOs and the people on firms to adapt ethical behaviour [48]. The scope of ethics programs are associated with environmental influences (such as media attention to a firm's ethical problems and representation at Conference Board meetings), and executive commitment to ethics [97]. Determining the effectiveness of codes of conduct is complex [50]. Effective codes of conduct have downstream impacts on employee conduct and corporate culture, which lead to larger scale impacts on stakeholders and society [25]. The effectiveness is defined by how corporate behavior fits the ethical standards and expectations of stakeholders and society. The quality of a code is dependent on its content and development, as visualized in Figure 2. The metrics are listed in bullet points and are used to quantify the code quality and CSR performance.

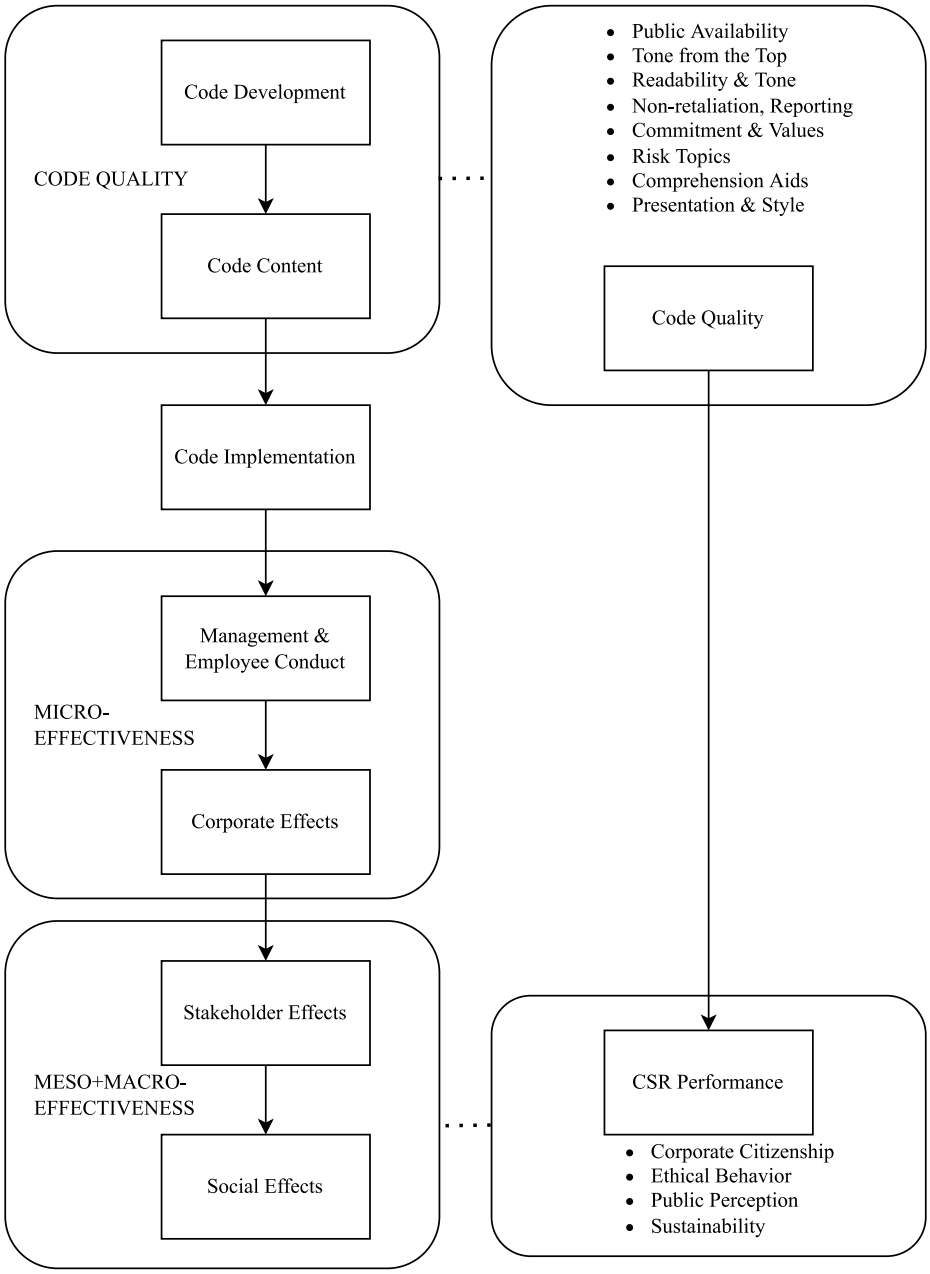

Fig. 2. Theoretical framework on the effectiveness of code quality on CSR performance, adapted from Erwin (2011)

The Ethisphere Institute is an organization which defines and measures corporate ethical standards and publishes a list of the most ethical companies. Although the Ethisphere Institute is a for-profit cooperation, it does aid organizations by offering resources and organizing events on the themes of ethics. The metrics on the right side of Figure 2 were compiled from quarterly publications in *Ethisphere magazine*. The Ethisphere Institute uses these metrics with its own weight to benchmark corporate codes and calculate overall grades.

According to the Ethisphere Insitute, the code quality is determined by the following factors:

- Its availability to the stakeholders;
- The level at which the leadership is visibly committed to values and topics covered;
- The style and tone of the language;
- The presence of a stated and explicit non-retaliation commitment, and dedicated resources for reporting code violations;
- The identification and embedding of corporate values and ethical commitments to its stakeholders;
- The extent to which the code addresses the appropriate and key risk areas for the company's given industry;
- The availability of comprehension aids to help employees and other stakeholders understand key concepts;
- How compelling the code is to read.

After implementing the code, the effectiveness can be seen within the organization. The management and employees are kept to certain standards, which has an effect on the organization as a whole. This, in turn, affects the stakeholders and society. CSR performance is considered to be a measure of the perceived and actual ethical behavior of organizations [25]. It is composed of the meso-effectiveness metrics of *Corporate Behavior* and *Ethical Behavior*, and the macro-effectiveness metrics of *Public Perception* and *Sustainability*. The perceptions on what is right, shaped on a higher level than just the organization, are the principles upon which CSR performance is reflected. A good ethical code enables establishing a climate of trust with stakeholders [51].

The availability of an ethical code, regardless of its content, has an impact of the perceptions of ethical behavior within an organization [3]. However, ethical codes are not a prerequisite for ethical conduct within organizations, as ethical behavior may exist in organizations without one [25].

As the ethical code conveys a message regarding the conduct of employees and third parties, it affects the daily operations of an organization. The outcome of certain business decisions depends on how the organizations believe they should act. Therefore, changes in the ethical code can have an effect on the processes in the organization.

4 Environmental, Social and Ethical Business Process Analysis

This section is dedicated to formulating metrics for environmental, social and ethical business process analysis (ESE-BPA). This section consists of different perspectives to be taken into account, with a link to their respective ESEA methods. Some aspects are used in multiple ESEA methods.

Environmental As for the environmental aspects, we can look at resource usage [68]. Many of the following approaches can be quantified, and are therefore suitable for comparison when redesigning business processes. Electricity usage and CO_2-emissions have been earlier identified [71]. Other resources which can be useful to take into account are the water usage and physical material usage, and the use of land [106]. The use of physical material can be seen as an umbrella term, as there are different perspectives on it.

First of all, it is possible to look at material waste. In a manufacturing process, we can look at the amount of raw material enters a process, and the amount which does not end up in the outcome of the process. There is a certain amount which end up as waste material. This can further be specified in which actions are being taken with waste material. Is it being recycled, or ends up being disposed?

Another perspective is looking at the suppliers of these raw materials. This perspective overlaps with supply chain management, and focuses on whether the suppliers of raw materials are local, participating in sustainable initiatives and the carbon footprint of the entire supply chain.

Social Regarding social aspects, it is focused on the human involvement in business processes. However, human involvement in ESEA looks at demographics such as female participation in the workplace. The activities in a business process carried out by humans can be analyzed using such demographics, looking at the role the humans have. As business processes may exist without human interference, this type of analysis may not be universally applicable.

The prospects for using social characteristics for business process analysis are slim. Diversity and inclusion are ideally measured across the workforce as overarching organizational metrics. However, if personnel are occupied with only one business process, it is an opportunity for analysis and it will be beneficial to do so.

Ethical Business ethics have been a topic of discussion for a long time. Reflecting on earlier philosophers mentioned in this thesis, Adam Smith argued that the mechanism of self-interested actors competing in the market will lead to maximized collectively beneficial outcomes [85]. Karl Marx questioned this view, expressing the question whether it is possible for essentially exploitative profit-seeking organizations being able to be ethical [62]. The ethical climate is determined by contextual factors such as the sociocultural environment and the form and history of an organization [93].

Ethics come to the surface mostly in the decision making process. The exercise of power involves moral responsibility [69]. Ethical decisions emerge out of dilemmas that

cannot be managed in advance through rules [15]. Organizations can provide guidance with the use of a code of conduct, but its contents may differ across organizations. The ethical climate may very well differ across cultures, which makes it difficult to unify ethical standards [81].

For processes, the considerations are twofold. First, it is possible to look at to which extent the business process align with ethical business goals and the code of conduct of the organization. This consideration is more focused on ethical business goals, since these first need to be established before deciding whether this is relevant. A second approach follows human involvement and the ethical risks of the human involvement in the process. Risks such as conflicts of interest or opportunities for bribing which affect the outcome of the process can be identified, together with the possible countermeasures. These countermeasures can be incorporated into organizational documents such as a code of conduct, or be mitigated through confirmation checks within the process itself.

The Ethisphere Institute has introduced the Ethics Quotient to account for five areas, which are *Governance*, *Leadership and Reputation*, *Ethics and Compliance Program*, *Culture of Ethics*, and *Corporate Citizenship and Responsibility* [111–113].

5 Method Overview

The aim of this thesis is to incorporate principles from current ESEA methods into a qualitative business process analysis technique. For this framework, its goal, stakeholders, and metrics are described.

5.1 Goal

The goal of ESE-BPA is derived from the goals of business process analysis and ESEA methods. Business process analysis aims to investigate properties of business processes in order to make it more effective, efficient, and adaptable [43,100]. The goal of ESEA is to account for the non-financial impact of an organization's economical actions [26]. An integrated goal for ESE-BPA is therefore phrased as the following:

ESE-BPA aims to investigate the environmental, social, and ethical properties of business processes in order to provide opportunities for business processes to be improved.

In this goal, improvement is not referred to in terms such as process efficiency. ESE-BPA aims to create and increase a positive outcome on the community by addressing not the organization as a whole, but by compartmentalization.

5.2 Stakeholders

There are different stakeholders to ESE-BPA. The process owner is responsible for the operation of a certain process. The process participants are human actors who perform the activities of a business process. On a higher level, there is the management of the organization which is interested in successful business operations and to improve the organization's public image. In addition, there are external groups which have interests, such as governments and NGOs which encourage corporate social responsibility.

5.3 Environmental Factors

As described earlier, many ESEA methods look at organizations on a higher level. However, some of the different categories mentioned in ESEA methods can be applied in process instances. To create an overview which methods address which parts of the business process, three pillars have been established. These three pillars cover different aspects of the business process which can be subject assessed. The ESEA methods, their terms and methodologies, and the pillars which they belong to, are found in Appendix A.

The three pillars are the following: **(1) Utilities and Emission** [102] [108, 110, 114, 119, 120, 123, 124, 129, 130, 134], **(2) Life Cycle Assessment and Waste Management** [102] [108–110, 114, 117–120, 122, 123, 130], **(3) Supply Chain Management and the Production Process** [102] [108, 114, 117, 120, 122, 130, 134]. Within some ESEA methods, the recommended actions affect more than one category and therefore the categories are non-exclusive. A simple example would be the delivery of the product to the customer. The transportation method contributes to the emission of an organization, as well as it is part of the distribution.

The three pillars and their contents are discussed below. Suggestions on which indicators to use or how to calculate these are presented. The specific measures which will be incorporated into ESE-BPA are formulated in chapter 6.

Utilities and Emission This category is directed at the resource usage and emission that takes place within business processes. The amount of resources provided by public utility companies or generated from their own efforts, such as gas, water, and electricity can be calculated. Regarding electricity, a distinction can be made to which extent the utilities are sourced from clean and renewable energy. For appliances, resource use estimation can be based on labels such as the EU energy label [115] or EnergyGuide [116]. Other indicators can be found in terms of energy efficiency, such as the number of process iterations an appliance can make before replacing a battery or refueling. For transportation, this can also be expressed in fuel economy, which relates distance travelled and the amount of fuel consumed.

In the case of emission, one would prefer to calculate the amount of emission for different greenhouse gasses. This does not only concern carbon dioxide, but also takes into account nitrous oxide and methane as they are the major contributors to climate change [47]. Again, the EU energy labels can be useful as they categorize motorized vehicles based on their carbon dioxide emissions in grams per kilometre travelled [115]. However, measuring nitrous oxide and methane emissions is not feasible for all organizations, as it requires specific equipment [121].

Life Cycle Assessment and Waste Management Life Cycle Assessment (LCA) takes a life cycle perspective when evaluating the environmental impacts of a product or system [9]. It covers a broad range of environmental issues such as climate change, freshwater use, toxic impacts on human health, depletion of non-renewable resources among others. It is to avoid burden shifting, which happens if efforts for lowering one type of environmental impact unintentionally increases other types of environmental impacts. All monetary costs associated with the life cycle are summarized in Life Cycle Costing (LCC), which is a useful complement in order to remain profitable [54].

Concepts of LCA are visible in a circular economy. A circular economy, *"[...] is an economic system that targets zero waste and pollution throughout materials life cycles, from environment extraction to industrial transformation, and to final consumers, applying to all involved ecosystems. Upon its lifetime end, materials return to either an industrial process [...] It exploits to the fullest the sustainability nested concept. Used energy sources are clean and renewable. Resources use and consumption are efficient [...]"* [70].

The application of LCA can aid in decision-making processes on an organizational scale [32]. There are positive environmental outcomes from recycling in different sectors [30,58,60]. Therefore, organizations should quantify their waste disposal, and the extent to which this waste is being repurposed by themselves or other organizations.

Supply Chain Management and the Production Process The definition of Supply Chain Management, is *"the strategic coordination of the traditional business functions*

and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole" [66]. Different business functions are management, marketing, finance, research and development, manufacturing, and more [103]. Especially when designing a new product, setting objectives and boundaries shape the nature of the supply chain. There are different models and techniques for evaluating the supply chain, such as Activity Based Costing [17], the Balanced Score Card [49], and the Supply Chain Operation Reference Model [107]. Different organizations may benefit from applying different methods [27].

Regarding business processes, it is useful to not look at the complete supply chain of an organization, but regarding one individual business process. For internal processes, the supply chain may be very limited. However, for extensive processes which require input from different parties, the upcoming suggestions might be of relevance. In manufacturing, one could look at the suppliers for their input resources. It can be beneficial to purchase these resources in a more sustainable fashion. An example of this would be to purchase from local partners, minimizing transport. In addition, partners with commitments to sustainability in the form of certification or sustainable business might be preferable. One could think of formulating a partner-oriented strategy, which is generally important in different fields [5,6,8,28].

Regarding the production, efficiency is important. The efficiency of business processes is measured in throughput, utilization and cost reduction [43]. For processes to become more sustainable, one could also take into account the resource efficiency and waste minimization. Resource efficiency has been described earlier to an extent, looking at process iterations per unit of resource.

5.4 Social and Ethical Factors

The social and ethical metrics suggested by ESEA methods are included in Appendix B in a similar fashion as was done with the environmental metrics.

Social The social factors include the **Process Demographics**. The demographics involved are the number of personnel and full-time equivalents to assess the scale of the process. Based on these numerical values, it is useful to look at their demographics such as gender disparity [111–113, 119, 120, 126–128, 131, 132]. Additional avenues to explore are disadvantaged or minority groups [119, 120, 127, 128]. These social characteristics are sometimes focused on the participation of these groups in management, rather than to the entire organization. There have been studies trying to explain the effectiveness of and conditions for female involvement in management positions[22,105]. In the scope of business processes, we can see that women are underrepresented among BPM professionals and that they present their competences differently than men [36]. This study considers the involvement in the workforce, which differs greatly per sector and per region [18,29,76,87].

Ethical The ethical factors are divided into two sections to address different needs. The first one focuses on the **Ethical Code**, and the second category is **Conflicts of Interest**.

The availability and enforcement of the ethical code are discussed in several methods [111–113, 119, 120, 132, 126]. It is seen as a ruleset for personnel to adhere to, as well as a preservation of the culture of an organization. The content however, can differ greatly per region as unification of ethical standards is difficult [81].

Conflicts of interest should be avoided in order to remain an integer organization. Within ESEA, there was little found about about avoiding these. Ethisphere mentions it in terms of governance and auditing [111–113]. Therefore, in the next section, additional avenues for auditing are proposed. As decisions can be part of a business process, monitoring is an aspect which can help in minimizing conflicts of interest.

6 Assessment Topics

This section focuses on the specific metrics to assess the quality of business processes in terms of environmental, social and ethical externalities. It begins with some general questions regarding the business process, followed by conceptualizations of the different methodologies from the previous chapter. The metrics are derived from the ESEA methods listed in Appendix A and Appendix B. The questions are presented in a format stating the question or metric, its purpose, and how the data should be presented. Although not mentioned explicitly, it is possible to give additional context to the data in order to provide further explanation. This goes for each variable, and will return in the ESE-BPA report.

The different purposes are (1) Identification, (2) Comparison, (3) Scale assessment. The identifying variables aids in organizing and connecting data to the original organization and process. The comparing variables serve for both internal and external analysis. For internal analysis, it is possible to size up data of one process to a different one within the organization, or to a different iteration of the process to track developments over time. The external analysis is for evaluating similar processes across different organization. This helps in gathering insights for potential future process adaptation, in addition to identify trends within the industry. The latter purpose, scale assessment, is for evaluating the impact a process has. This is done in terms of assets involved and its significance for the organization.

6.1 General information

General information is collected in order to compare different samples of ESE-BPA. It enables comparison over different iterations of ESE-BPA within the organization.

General information is distinguished into different categories. The first category, listed in table 2 can be considered as metadata of the assessment. It entails basic information such as the name of the organization and the process included in the assessment. In addition, information regarding the assessment is included to allow for comparison between different versions of the assessment. The second category is focused on the process characteristics, such as its size and significance. This is displayed in table 3. The significance of the process aims to discover the importance of the process for the organization. Answering questions such as to which extent the process is part of the core business activities for the organization and its contribution to the revenue of the organization can help in providing a significance value for this question.

Variable	**Purpose**	**Expected answer type**
1. Organization	(1) Identification	Text
2. Process name	(1) Identification	Text
3. Date of Assessment	(1) Identification and (2) comparison	Date
4. Assessment Version	(1) Identification and (2) comparison	Numerical

Table 2. ESE-BPA General information: Metadata

Variable	Purpose	Expected answer type
1. Number of process iterations	(2) Comparison and (3) Scale assessment	Numerical over time
2. Number of personnel involved	(2) Comparison and (3) Scale assessment	Numerical
3. Process significance	(3) Scale assessment	Numerical

Table 3. ESE-BPA General information: Process characteristics

6.2 Environmental

Environmental data is covered in the categories distinguished in the previous chapter. The first category, **Utilities and Emission** is displayed in Table 4. It focuses on the average resource usage and emission per process iteration. This allows for generalization, as different instances of business processes may vary. The resources included are the usage of electricity, gas, and water. For now, the emission is limited to the emission of CO_2, but other forms of emission can be included in the future.

Table 5 refers to the **Life Cycle Assessment and Waste Management**. It relies on metrics about the use of materials and the extent whether these materials are recycled or repurposed, or will be in the upcoming future.

The last category, **Supply Chain Management and the Production Process** is displayed in table 6. It is dedicated to the number of suppliers and whether they are local and (certifiably) sustainable. In addition, it looks at the resource efficiency which can be calculated using data from the other tables. The raw material efficiency is calculated dividing the raw material waste over the raw material use. The same procedure is executed for calculating the water efficiency.

Variable	Purpose	Expected answer type
1. Electricity usage	(2) Comparison and (3) Scale assessment	Numerical (Energy)
1.A Of which clean and renewable energy	(2) Comparison	Numerical (Energy) or Relative
2. Gas usage	(2) Comparison and (3) Scale assessment	Numerical (Volume)
3. Water usage	(2) Comparison and (3) Scale assessment	Numerical (Volume)
3.A Of which recycled	(2) Comparison	Numerical (Volume) or Relative
4. CO_2-emission	(2) Comparison and (3) Scale assessment	Numerical (Mass)

Table 4. ESE-BPA Environmental data: Utilities and Emission

Variable	Purpose	Expected answer type
1. Raw material use	(2) Comparison and (3) Scale assessment	Numerical (Mass)
1.A Of which recycled/repurposed	(2) Comparison	Numerical (Mass) or Relative
2. Raw material waste	(2) Comparison and (3) Scale assessment	Numerical (Mass)
2.A Of which to be recycled/repurposed	(2) Comparison	Numerical (Mass) or Relative
3. Water waste	(2) Comparison and (3) Scale assessment	Numerical (Volume)
3.A Of which to be recycled/repurposed	(2) Comparison	Numerical (Volume) or Relative

Table 5. ESE-BPA Environmental data: Life Cycle Assessment and Waste Management

Variable	Purpose	Expected answer type
1. Number of Suppliers	(2) Comparison	Numerical
1.A Of which local	(2) Comparison	Numerical or Relative
1.B Of which (certified) sustainable	(2) Comparison	Numerical or Relative
1.B.I Of which deliberately selected for their sustainability	(2) Comparison	Numerical or Relative
2. Raw material efficiency	(2) Comparison	Relative
3. Water efficiency	(2) Comparison	Relative

Table 6. ESE-BPA Environmental data: Supply Chain Management and the Production Process

6.3 Social

The social characteristics and considerations are affected by the demographics involved in the process. It is in respect to the personnel involved and aims to make organization attentive of their personnel. For now, it looks at gender and heritage in an attempt to encourage diversity. In the future, other attributes may be added as organizations might value other diversity characteristics over the ones included now.

Variable	**Purpose**	**Expected answer type**
1. Number of personnel involved	(2) Comparison and (3) Scale assessment	Numerical
1.A Of which male/female/other	(2) Comparison	Numerical or Relative
1.B Of which non-native	(2) Comparison	Numerical or Relative
2. Number of FTEs involved	(2) Comparison and (3) Scale assessment	Numerical
2.A Of which male/female/other	(2) Comparison	Numerical or Relative
2.B Of which non-native	(2) Comparison	Numerical or Relative

Table 7. ESE-BPA Social data: Process demographics

6.4 Ethical

The ethical considerations are mostly focused on the possibility and prevention of conflicts of interests occurring. Table 8 looks at the decision-making process within business processes. It does so by evaluating all decisions and assessing whether these decisions are dependent on objective data. In addition, it considers human involvement by investigating the amount of decisions which outcome is decided by a human. Furthermore, it looks at whether there is some form of monitoring by evaluating how many decisions are checked, and whether the check is performed by the same human.

The presence of an ethical business code or an organizational code of conduct is discussed in Table 9. Organizations are asked whether they have such a code, what their code entails, and how the code is implemented and enforced among the personnel.

Variable	Purpose	Expected answer type
1. Number of decisions	(2) Comparison and (3) Scale assessment	Numerical
1.A Of which are dependent on objective data	(2) Comparison	Numerical or Relative
1.B Of which are made by humans	(2) Comparison	Numerical or Relative
1.C Of which are checked	(2) Comparison	Numerical or Relative
1.C.I By a different human	(2) Comparison	Numerical or Relative
1.C.II By the same human	(2) Comparison	Numerical or Relative

Table 8. ESE-BPA Ethical data: Conflicts of interest

Variable	Purpose	Expected answer type
1. Presence of an Ethical Code or Code of Conduct	(1) Identification	Text (Y/N)
2. Code topics	(2) Comparison and (3) Scale assessment	Text (List)
3. Code implementation and enforcement	(2) Comparison	Text (List)

Table 9. ESE-BPA Ethical data: Ethical code

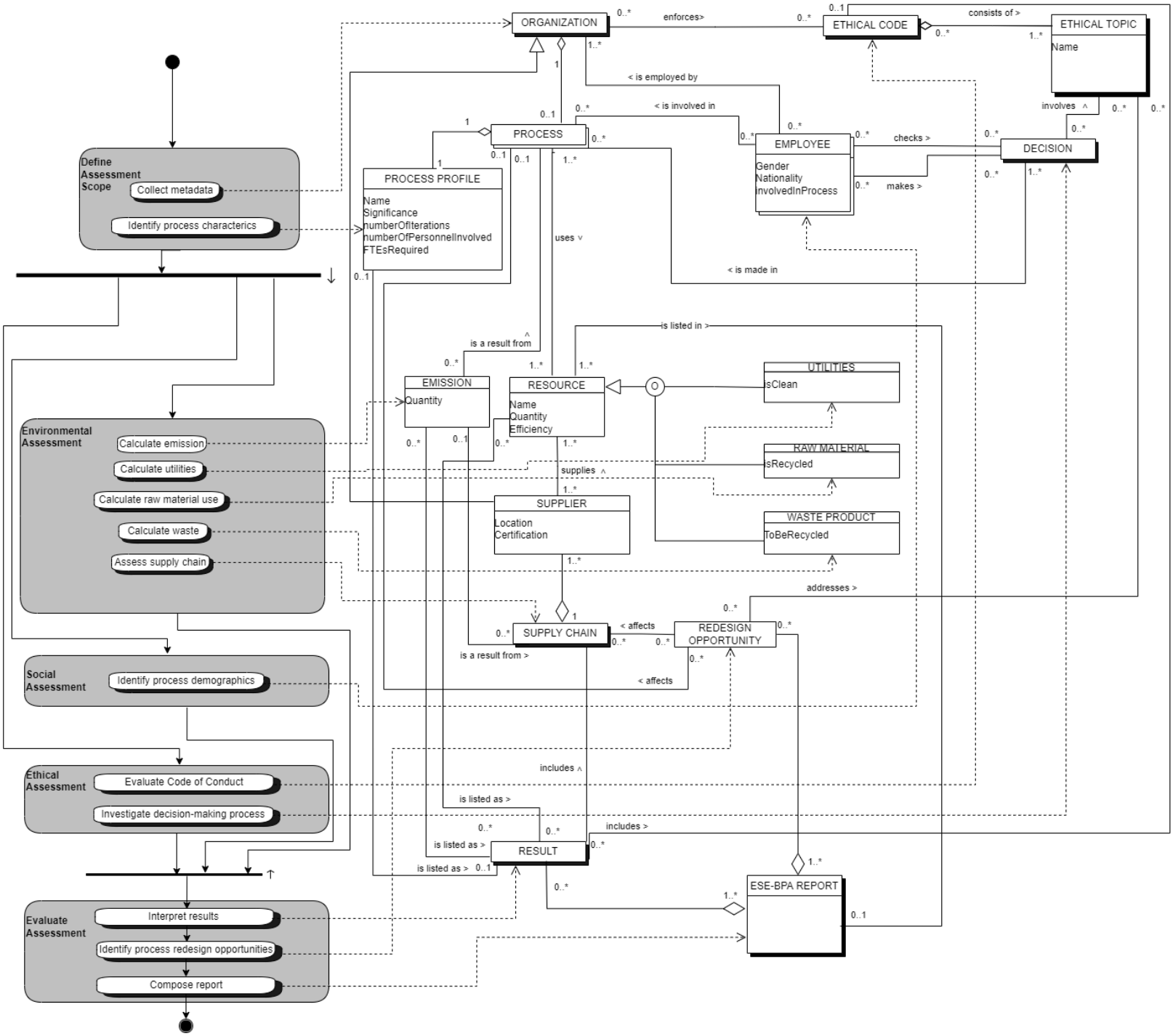

Fig. 3. Process Deliverable Diagram of ESE-BPA

7 Assessment Instructions

The process of performing ESE-BPA is explained in this section. This is achieved through the use of a process-deliverable diagram (PDD). This meta-modelling technique, based on UML activity and class diagrams, shows the activities and concepts involved in the method [98]. It contains a process view on the left-hand side of the diagram and a deliverable view on the right-hand side. In addition, it is accompanied with an activity table and a concept table. These describe the different elements included in the PDD.

Below, the PDD in Figure 3 is explained. First, the process view is covered, including the activity table. Second, the deliverable view is discussed, using the concept table. The continuation and follow-up steps are discussed last.

7.1 Process View

The process view on the left-hand side of the diagram is discussed. The process consist of five activities, some of which include sub-activities. A simplified depiction of the process is included in Appendix C. Most sub-activities in the process are unordered, ergo the sequence in which they are executed is undefined. A summarized description of the activities is included below. The (sub-)activities are configurable elements, as organizations can benefit from individual forms of assessment as well. A more detailed explanation of the sub-activities is included in Table 10.

- **Scope Assessment**: The method starts with scoping the analysis. In this process, metadata regarding the organization is collected. Furthermore, the process characteristics are identified. These activities should be completed before branching into the three groups of assessment.
- **Environmental Assessment**: The environmental assessment contains five sub-activities. These are the calculation of emissions, utilities, raw material use, and waste, as well as assessing the supply chain. The activities serve the purpose to collect data on which further actions can be based.
- **Social Assessment**: The social assessment is concerned with identifying the process demographics. It looks at the employees involved in the process and their characteristics.
- **Ethical Assessment**: The ethical assessment is divided into two unordered activities. The activities are evaluating the organization's Code of Conduct and investigating the decision-making process within the business process.
- **Evaluate Assessment**: The evaluation of the assessment serves the purpose of transforming the collected data into opportunities for process redesign. After interpreting the results and evaluating the different parts of the business process, you can identify areas in which the process can be strengthened. Afterwards, these opportunities for redesign are included in an ESE-BPA report. Together, with the collected data in earlier steps, it proposes new courses of action and allows for comparison in the future.

Activity	Sub-Activity	Description
Define Assessment Scope	Collect metadata	The ORGANIZATION and in which the assessment takes place and its characteristics are identified.
	Identify process characteristics	The PROCESS is illustrated in a PROCESS PROFILE using its attributes.
Environmental Assessment	Calculate emission	The EMISSION as a result from the PROCESS are investigated. Furthermore, the EMISSION as a result from the SUPPLY CHAIN is included. For now, this is limited to CO_2-EMISSION.
	Calculate utilities	The UTILITIES used in the PROCESS are investigated. The amount of UTILITIES, as well as the nature of the UTILITIES, serve as data points.
	Calculate raw material use	The RAW MATERIALS used in the PROCESS are investigated. The amount of RAW MATERIAL, as well as the nature of the RAW MATERIAL, serve as data points.
	Calculate waste	The WASTE PRODUCT as a result of the PROCESS is investigated. The amount of WASTE PRODUCT, as well as whether it will be recycled, serve as data points.
	Assess supply chain	The SUPPLY CHAIN is investigated. The location and certification of each SUPPLIER is serves as data points
Social Assessment	Identify process demographics	The human involvement in the PROCESS is assessed. The focus lies on the EMPLOYEE and its characteristics
Ethical Assessment	Evaluate code of conduct	The ETHICAL CODE is investigated. The focus lies on different instances of ETHICAL TOPIC included in this ETHICAL CODE.
	Investigate decision-making process	Each DECISION step in the PROCESS is evaluated. In addition, the involvement of the EMPLOYEE in each DECISION is assessed.

Continued on next page

Activity	Sub-Activity	Description
Evaluate assessment	Interpret results	The goal of this activity to clarify the RESULTs. It seeks to make sense of the PROCESS PROFILE and the data of the EMISSION, RESOURCEs, the SUPPLY CHAIN, and the ETHICAL CODE.
	Identify process redesign opportunities	The goal of this activity is listing each REDESIGN OPPORTUNITY. A REDESIGN OPPORTUNITY addresses an ETHICAL TOPIC, or affects the SUPPLY CHAIN or the PROCESS itself.
	Compose report	The ESE-BPA REPORT consists of all instances of REDESIGN OPPORTUNITY and the results of each other activity in the assessment.

Table 10: ESE-BPA: Activity Table

7.2 Deliverable View

The concepts in the deliverable view are discussed below. The relations are explained, and a description of the concepts are included in Table 11. The following relations are applicable:

- An organization might enforce an ethical code consisting of at least one ethical topic.
- An organization employs at least one employee, which might make and check decisions in a process. These decisions might involve ethical topics.
- A process has a process profile.
- The resources used in a process are supplied by a supplier. These resources are divided into utilities, raw material and waste product.
- A supplier is part of a supply chain.
- Emission can be a result of a process and a supply chain.
- Redesign opportunities may affect the process, the supply chain or ethical topics, and are included in the ESE-BPA report.
- Results include te data of the process profile, and the data about emission, the resources, the supply chain, and the ethical code. Results are listed in the ESE-BPA report.

Concept	Description
ORGANIZATION	An ORGANIZATION is a group of people working together on a particular purpose.
ETHICAL CODE	An ETHICAL CODE is a set of rules outlining the norms, rules and practices for employees of an organization.
ETHICAL TOPIC	An ETHICAL TOPIC is an area to which certain norms, rules and practices are applicable.
PROCESS	A PROCESS is a series of structured and related activities, with dedicated resources, resulting in a certain outcome.
PROCESS PROFILE	A PROCESS PROFILE serves to summarize the PROCESS by using its characteristics.
EMPLOYEE	An EMPLOYEE is a human being, hired by an ORGANIZATION, exchanging performed work for money.
DECISION	A DECISION is an activity in a PROCESS in which a selection is made on how the PROCESS continues. This selection is made out of different alternatives, and can be made nd checked by an EMPLOYEE.
EMISSION	The production and discharge of gasses. In this context, it is specified to CO_2-emission.
RESOURCE	The supply of materials and other assets which are used to facilitate the PROCESS.
UTILITIES	UTILITIES comprise of electricity, gas, and water.
RAW MATERIAL	RAW MATERIAL is considered to be the initial goods which are made into a product as the result of a PROCESS.
WASTE PRODUCT	WASTE PRODUCT is a subset of the RESOURCE which is discarded after primary use.
SUPPLIER	A SUPPLIER is an ORGANIZATION which delivers resources.
SUPPLY CHAIN	The SUPPLY CHAIN is the alignment of ORGANIZATIONS as a goal to deliver goods or services to a consumer.
REDESIGN OPPORTUNITY	A REDESIGN OPPORTUNITY is an area for potential improvement. In this context, it is specified to improvements regarding environmental, social and ethical conditions.
RESULT	The RESULT is the data of the activities. It contains the PROCESS PROFILE, EMISSION, RESOURCEs, the SUPPLY CHAIN, and the ETHICAL CODE. It is included in the ESE-BPA REPORT
ESE-BPA REPORT	The ESE-BPA REPORT is the final statement in ESE-BPA. It contains the RESULTs of the activities, as well as the list of REDESIGN OPPORTUNITIES.

Table 11: ESE-BPA: Concept Table

7.3 Continuation

After performing ESE-BPA, the organization is left with an ESE-BPA report. A template for the report is included in Appendix D. Its purpose is not to be put away in a drawer and forgotten. This report can serve as a guideline on which to base further process redesign choices. This may complement portfolio decision analysis methods [57]. Together, with other factors such as the costs and the effects on process effectiveness, the ESE-BPA report can play parts in order to take considerations into account. It is up to the organization to assess their priorities and make sure that the process redesign is beneficial.

Below, there are some suggestions on how the different assessments can transpose into actions. These are categorized per assessment type. Note that the suggestions are merely examples, and there are many different areas of opportunity and possible directions in which organizations may identify improvements. In subsequent iterations of ESE-BPA, these improvements will be visible when comparing different reports.

Environmental The assessment itself lies out directions regarding **Utilities and Emission**. If, in any way, it is possible to reduce these or change the kind of the utilities to a more sustainable form of energy, organizations should investigate these opportunities. These actions are directly affecting the process, such as reducing in the amount of electricity used.

Similar actions can be identified when looking at **Life Cycle Assessment and Waste Management**. If it is possible to reduce the use of material and/or increase the share of the used material being recycled, it has its benefits. Additionally, when the opportunity rises to reduce the waste and/or increase the share of waste being repurposed in the future, it is worth investigating.

The suggestions in the last category, **Supply Chain Management and the Production Process**, are in assessing the current supplier base. A second suggestion ties in with the other suggestions which were mentioned earlier. When it is possible to reduce the use and waste of material or water, the efficiency may increase.

Social Diversity among the workforce depends on the hiring process of an organization as a whole. Hiring tools predicting the effectiveness and performance of new employees have shown biases in gender and race [10]. A suggestion for improvement is Pareto-optimization in personnel selection[20]. This means that different weights are put on selection criteria, in an attempt to achieve diversity. Furthermore, a different distribution of tasks among the workforce might be an option to increase the diversity within the scope of the selected process. This is not a feasible option for all organizations, but in some cases this can be considered.

Ethical The suggestions in the ethical scope are in decreasing the likelihood of **Conflicts of Interest** happening. Suggestions are increased monitoring the decision making

process, or reducing the decisions being made by human employees. This can be done by dividing the responsibilities over different employees, as well as by assigning additional monitoring tasks.

In addition, it allows for reflecting on the **Ethical Code** and potentially revising or complementing it. This is in an attempt to increase the extent to which the process reflects the organization's public image.

8 Conclusion

With the creation of ESE-BPA as a method for process analysis, an answer is given to the research question *In which respect can individual business processes be analyzed in terms of environmental, social, and ethical externalities?* By incorporating metrics from environmental, social and ethical accounting (ESEA), it was possible to create an integrated assessment method. The method of environmental, social and ethical business process analysis (ESE-BPA) enables organizations to assess their business process to an extent which has not yet been explored on this level.

ESE-BPA looks at business processes in terms of their general characteristics, utilities and emission, life cycle assessment and waste management, supply chain management and the production process, process demographics, conflicts of interest, and ethical code. By collecting data in these categories, a report can be drawn up listing opportunities for process redesign in an attempt to improve the process in these areas.

Besides business process redesign, ESE-BPA also gives other insights. It helps in understanding the internal workings within the organization. It aids in shaping and identifying (long term) developments and benchmarks. Lastly, it enables creating an overview of transitions in the industry.

9 Discussion and Limitations

ESE-BPA shows that it is possible to fit the broad organization-wide metrics from ESEA methods to the smaller scope of business processes. In respect to the dimensions of Green BPM from Figure 1, ESE-BPA has as goal both to reduce environmental impact and foster cultural change. In terms of process stages, ESE-BPA plays a part in all stages of the process lifecycle. Lastly, regarding the management activities, ESE-BPA supports doing, checking and acting. However, there are some limitations to this research.

A notable limitation is that the proposed method has not yet been tested in practice. This is the main suggestion for further research. Empiric evidence will provide a strong foundation for supporting or rejecting the usefulness of ESE-BPA. The author's recommendation lies therefore in conducting a case study. Ideally, this case study will be conducted several times in organizations of various sizes, to strengthen the claims which can be made afterwards. This does not mean that this method is completely unsubstantiated. The proposed method is based on ESEA methods applied in organizations in various sizes, ranging from small and medium-sized enterprises to large multinationals. The methods applied in ESE-BPA are similar metrics adapted from ESEA methods to fit a smaller scope.

When doing a case study, it can be interesting to see how organizations will use ESE-BPA. Questions about whether the method is considered to be useful as a whole, or whether only parts are used can be answered. The latter gives a substantiated reason to further investigate customization and configuration of ESE-BPA. By tailoring ESE-BPA with configurable elements, it is more easily adept to changes from new ESEA methods, new techniques, or other findings in how sustainability or ethics can be further improved.

Furthermore, it might pose troublesome to fit utility data and emission data to the scope of one process. In an order-to-buy process, it could become difficult to determine emission of the transportation of the goods to the buyer. An example could be a truck delivering multiple orders of different organizations in one delivery route. A question would be if you divide the total emission over all orders, or do you account for the share of the delivery route an order has spent in the truck. In the end, a possible goal could be to estimate the average of all process instances.

Another limitation is the incorporation of the social and ethical topics into this method. As mentioned in this thesis, the social metrics are less shaped by the process itself, but more by the organization itself. To a lesser extent, this holds true for the ethical side of ESE-BPA as well. Topics such as diversity among the workforce and the ethical code can be considered as themes which affect the entire organization. Changes to these artifacts will not only affect the process, but the organization as a whole. Therefore one might say that any alterations in these areas could have greater consequences, and should therefore be more carefully implemented.

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Appendix A: ESEA methods and their suggested categories and metrics for assessing environmental impact

ESEA Method	Utilities & Emission	Life Cycle Assessment & Waste Management	Supply Chain Management & The Production Process
Asset4/Thomson Reuters	– Environmental and Social Governance – Resource Use Score – ESG Emissions Score		– TR ESG Resource Use Score
B-Impact Assessment	– Resource Conservation Impact Business Models	– Resource Conservation Impact Business Models	– Supply Chain Environmental Impact
Common Good Balance Sheet	– Reduction of environmental impact	– Impact on the environment of the use and disposal of products and services – Reduction of environmental impact	– Environmental sustainability in the supply chain
Eco-Management and Audit Scheme (EMAS)	– Environmental aspects – Environmental responsibilities – Environmental data	– Environmental aspects – Environmental responsibilities – Environmental data	– Environmental aspects – Environmental responsibilities – Environmental data
ESG Reporting Guide (Nasdaq Stock Exchange)	– ESG metrics	– ESG metrics	

Continued on next page

ESEA Method	**Utilities & Emission**	**Life Cycle Assessment & Waste Management**	**Supply Chain Management & The Production Process**
Global Reporting Initiative Standards	– GRI 302: Energy – GRI 303: Water and Effluents – GRI 305: Emissions	– GRI 301: Materials – GRI 306: Effluents and Waste	– GRI 308: Supplier Environmental Assessment
Global Reporting Initiative Reporting Principles and Standard Disclosures	– G4-EN3 – G4-EN6 – G4-EN9 – G4-EN15 – G4-EN19	– G4-12 – G4-EN2 – G4-EN10 – G4-EN22 – G4-EN23	– G4-EN32 – G4-EN33
ISO26000	– Emissions to air – Energy efficiency	– Life cycle approach – Discharge to water – Waste management – Minimized resource requirements of a product	– Cleaner production and eco-efficiency – Efficency in the use of materials – Minimized resource requirements of a product
Natural Capital Protocol - Principles and Framework	– Consumptive business input: Water, Energy – Business output: GHG emissions	– Business output: Solid waste	
S-CORE Assessment tool	– Facilities	– Facilities	– Purchasing

Continued on next page

ESEA Method	**Utilities & Emission**	**Life Cycle Assessment & Waste Management**	**Supply Chain Management & The Production Process**
Social Progress Index	– Greenhouse gas emissions		
Sustainability Assessment of Food and Agriculture Systems (SAFA)	– E1: Atmosphere – E2: Water – E5: Materials and Energy	– E2: Water – E5: Materials and Energy	– C4: Local economy
Sustainability Accounting Standards Board (SASB) Conceptual Framework	– GHG Emissions – Energy management – Fuel management – Water and wastewater management	– Water and wastewater management – Waste and hazardous materials management – Lifecycle impacts of products and services	– Supply chain management
Task Force on Climate-related Financial Disclosures (TFCD) - Recommendations	– Resource efficiency – Energy source	– Transition risks	– Transition risks

Table 12: ESEA: Environmental Categorization

Appendix B: ESEA methods and their suggested categories and metrics for assessing social and ethical impact

ESEA Method	Process demographics	Ethical Code	Conflicts of Interest
2020 Social Progress Index	– Inclusiveness – Equality of political power		
Ethisphere	– Corporate Governance	– Corporate Governance – Program Structure, Oversight, Responsibility, and Resources – Written Standards, Policies, and Procedures – Ethics and Compliance Training, Awareness and Communication – Detection, Monitoring and Auditing – Measurement of Ethical Culture	– Corporate Governance – Due Care – Detection, Monitoring, and Auditing
A Framework & Guidance for Co-operatives	– Membership Demographics – Gender equality at senior levels		
Global Reporting Initiative Reporting Principles and Standard Disclosures	– G4-10 – G4-40 – G4-LA12	– G4-56 – G4-57 – G4-58	

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ESEA Method	**Process demographics**	**Ethical Code**	**Conflicts of Interest**
Global Reporting Initiative Standards	– GRI 405: Diversity and Equal Opportunity	– GRI 102: General Disclosures	
International < IR > Framework	– Governance	– Governance	
Social & Human Capital Protocol	– Inclusion and Diversity	– Law and order	
Value Based Checklist for Social Firms	– Promote employment of disadvantaged people		

Table 13: ESEA: Social and Ethical Categorization

Appendix C: A Process Model simplifying the Process Deliverable Diagram of ESE-BPA

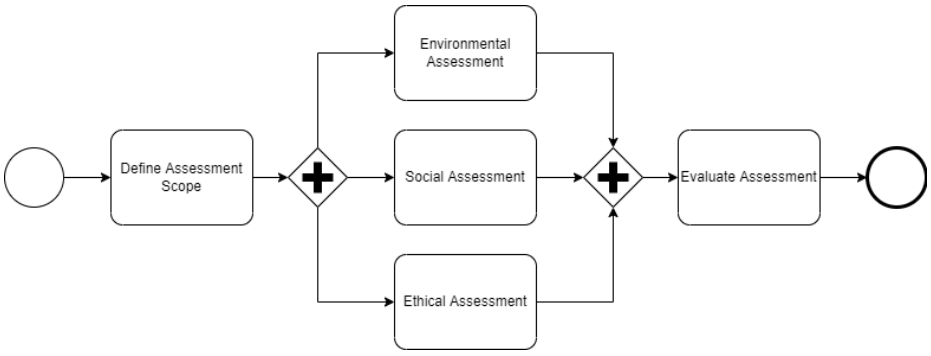

Fig. 4. A simplified Process Model of ESE-BPA

Appendix D: ESE-BPA Report: Template

Front Page
The front page includes the metadata of the assessment, as depicted in Table 2.
Preface / Summary
This page includes a statement explaining the reasoning behind performing ESE-BPA. Furthermore, a brief summary of the results is presented.
Process Characteristics
This section includes some basic information regarding the process. The bare minimum of information included is listed in Table 3.
Example: The manufacturing process of an electric bicycle happens 15.000 times per year. There are 16 employees involved in the process. This process accounts for 35% of the revenue.
Environmental: Utilities and Emission
This section includes the details listed in Table 4. The usage of utilities, as well as whether their source is renewable, is listed. Furthermore, the CO_2-emission of the process is included.
Example: In the factory, 95.000 kWh on electricity is used on a yearly basis. Of this amount, 12.000 kWh is generated by solar panels, which accounts for around 12% of clean energy. The factory uses 15.000 m^3 of natural gas per year. The amount of water used is 250 m^3 per year, of which 85% (212,5 m^3) is recycled. The yearly CO_2-emission is 8,5 tons.
Environmental: Life Cycle Assessment and Waste Management
This section includes the amount of raw material being processed and whether it is recycled. Furthermore, it looks at the waste of raw material and water, and the extent of the waste being recycled or repurposed, as listed in Table 5.
Example: The process of building a car requires 1.600 kg of raw material. The plastics used, which amount to 170 kg, have been recycled. About 10% of the steel (100 kg) is also recycled. In total, this is 17% of the total raw material. The total waste of raw material is 200 kg. 50% (100 kg) of this is being repurposed within the organization. Regarding water, a total amount of 30 m^3 per year is considered waste. 15% (4,5 m^3) is recycled by an external party.
Environmental: Supply Chain Management and the Production Process
This section includes details about the suppliers and the efficiency of raw material and water, as listed in Table 6.
Example: A furniture company uses five suppliers for their resources to build a sofa. Three of these five are located within a radius of 20 km. One out of the five suppliers is labeled as a Fairtrade organization. This supplier has not been selected because of its sustainability.
Social: Process demographics
This section includes information of the personnel involved. The variables are listed in Table 7.
Example: Within the process of assembling an electrical car, nineteen employees are involved. They are eleven male and eight female employees, of which one foreign employee. In total, three FTEs are involved. Two of those are distributed over the male employees, and one is distributed over the female employees. 0,3 FTE is assigned to the

foreign employee.

Ethical: Conflicts of Interest

This section is dedicated to the decision-making process within the process, as listed in Table 8. It aims to provide insight in the risk of conflicts of interest occurring.

Example: Within the process of handling an application for a mobile phone subscription, there are five decisions. Four of these are based on objective data. Five of the decisions are made by humans. Four of the decisions are checked within the process, of which three are checked solely by humans. Two of the three are checked by other employees, whereas one is checked by the one making the decision.

Ethical: Ethical Code

This section delves into the Code of Conduct of the organization. It looks at the topics included, as well as how the code is implemented and enforced, as listed in Table 9.

Example: At a car manufactoring company, there is a Code of Conduct. The code of conduct addresses legal issues, compliance and regulation, trustworthiness, respect, responsibilities, fairness, diversity, and dress codes. The enforcement is regulated through fines and penalties for the personnel, as well as potential legal action against the organization and its leaders.

Evaluation

This section lists the redesign opportunity in each section. Per opportunity, the considerations are included. Regarding the process itself, the impact of the redesign opportunities in terms of costs, time, quality and flexibility are listed, based on the Devil's quadrangle [12,23,80]. Furthermore, changes regarding the Code of Conduct can be proposed. Using this information, the organization can proceed to introduce alterations.