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The Role of Structural Context in Making Business Sense of Investments for Sustainability–A Case Study

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Abstract: Energy efficiency is an important means for sustainable manufacturing. One action for manufacturing companies to improve energy efficiency is through investments. While these investments often are profitable, opportunities remain unexploited. This paper explores the structural context of the investment decision-making process by examining the associated activities, procedures, and the role of information. While the structural context may limit complex investments that do not fit predefined rules and controls, such as energy efficiency and other sustainability-related investments, it remains a scarcely studied aspect of investment decision-making for energy efficiency investments. Method-wise, the paper is based on a case study of a major investment at a pulp and paper company, motivated and justified based on productivity, strategic, energy, and sustainability rationales. The paper contributes with illustrating how configurations of internal investment activities and procedures may be crucial for sustainability-related investments to pass through the investment process. Moreover, the configuration of activities and procedures is also indicated as influential for the way in which an investment is executed. Hence, for energy efficiency and other sustainability-related investments to make business sense constitutes more than achieving desirable payback periods; the structural context should be considered.

Keywords: energy efficiency; sustainable manufacturing; investment decision-making; structural context; non-energy benefits

1. Introduction

Improving resource efficiency, such as energy efficiency, is one important means for sustainable manufacturing [1], industrial sustainability [2], as well as competitiveness [3]. As discussed by Cagno et al. [2], industrial sustainability builds on the triple bottom line reasoning for an industrial context, including actions within the areas of eco-efficiency (including energy efficiency) as well as occupational health and safety (please refer to [2] for further reading). In an industrial context, e.g., the manufacturing industry, energy is a vital resource and in terms of end-use (both for energy and its adjacent greenhouse gas emissions), the industrial sector is the largest contributor; therefore, actions on the demand-side are crucial for mitigating climate change [4]. Such actions include sustainable manufacturing practices such as making energy efficiency investments. Energy efficiency is also one important constituent of the seventh sustainability development goal (SDG7) through target 7.3, stating that the global rate of energy efficiency should double by 2030 [5]. SDG7, which concerns access to affordable, clean, sustainable, and reliable energy [5] has also shown to be positively correlated to several other SDGs [6]. Hence, improving energy efficiency is important for manufacturing companies, the manufacturing industry, and in contributing to global sustainable development. This paper takes an internal firm perspective and aims to advance our understanding of the investment process for energy efficiency investments and provide implications for how to enable for more investments in resource efficiency and sustainability to be adopted and implemented in industrial companies, i.e., to provide

new insights for investment decision-making. This endeavor entails both addressing the traditional business arguments for energy efficiency, i.e., to make business sense of these opportunities, as well as to delve further into the internal obstacles pertaining to the formal investment decision-making process and its activities and procedures.

Improving energy efficiency may be addressed as an aspect of the environmental side of companies' sustainable operations [7] and a common constituent of companies' environmental strategies [8]. However, improving energy efficiency goes beyond the environmental dimension and Epstein and Yuthas [9] (p. 27) highlight becoming more energy efficient as an example of a sustainability choice that is a "no-brainer," due to its financial advantages. Potential cost reductions have also been identified as a top ranked driver for improving energy efficiency [10–13]. However, it has also been indicated that high initial investments and long payback periods hinder their adoption, e.g., [14,15], as well as lack of time and other priorities, e.g., [10,13,15–19], and it has been posited that "in the absence of an explicit preference or dedicated budget for climate-change- or energy-related investments, companies tend to prefer investments that enable business growth" [20] (p. 422). Meanwhile, there remains an untapped potential for improving industrial energy efficiency [21]. Hence, there is a need for knowledge on why these "no-brainer" sustainability investments are not undertaken to a higher extent.

Sustainability-related investments are becoming increasingly important yet remain under-researched in the capital investment literature [22]. Capital investments include for example machines, buildings, or acquisitions [23], are often irreversible [24] and have long-term implications for the investing company [23,25]. Energy efficiency investments in the industrial sector are capital investments that improve energy efficiency and where the return on the investment, to a certain degree, results from a reduction in energy use and thus energy cost savings [26]. Making capital investment decisions, as in the case of energy efficiency investments, means making important decisions related to resource allocation and ensuring alignment with strategic directions. Corporate management therefore creates an investment process [23,27,28], including, for example, investment manuals and authorization processes [29,30], and pre-set hurdle rates that function as means for motivation and control [23]. Simons [28] (p. 138) described this as "the set of formal routines and procedures designed to process and evaluate requests to acquire new assets," and denotes such formal systems as critical for guiding managers in their resource allocation decisions, providing a framework, analytical tools, and guidelines. However, Strauch et al. [31] note that previous studies on the investment decision-making processes tend to focus on isolated factors and fail to address the investment process from the multilevel perspective it requires.

Bower [27] defined structural context in terms of formal organization, role descriptions, information and control systems, and reward systems; "the role of structural context is that it shapes the purposive manager's definition of business problems by directing, delimiting, and coloring his focus and perception; it determines the priorities which the various demands on him are given.—Structural context is particularly important because all of its elements are subject to control by top management. Thus, management has in its hands the levers that influence behavior of managers many levels below the top of the hierarchical organization." [27] (p. 73). In line with Segelod [29] this study is concerned with the structural context relevant for the investment process and investment control. By examining the structural context in which investment decisions are taken [27], and the predefined and formal procedures investments are subject to [23], this paper seeks to contribute with insights for sustainability-related investments and how they may be more widely implemented. The position taken in this paper entails an inquiry where the steps of the process and the involvement of multiple managers are acknowledged [2,24,27,31,32], and the internal pre-decision controls such as manuals and policies [29,33] and management control activities such as planning, coordination, and evaluation [34] are addressed. Hence, three main concepts can be delineated that will be the focus of this paper: Activities, i.e., what takes place in the investment process; procedures, i.e., through which it is stipulated how and by whom; and information, i.e., input.

It has also been argued that formal investment guidelines are characterized by simple rules and may be difficult to change once established, especially in large and decentralized organizations [30].

Hence, on one hand, the activities and procedures provide guidance for alignment with strategic goals. On the other hand, the same activities and procedures may instead limit the development and introduction of new processes and hamper necessary adaptations due to, for instance, changes in the company's financial or organizational conditions, such as regulations [33]. This ambiguity raises the question of how the structural context influences the investment process for investments that do not easily fit these predefined activities and procedures, such as energy efficiency investments and other sustainability-related investments.

Energy efficiency investments may be related to both core production processes or support processes such as lighting [26,35]. In addition, they result in both energy savings and so-called non-energy benefits, including, for example, reduced maintenance costs, increased production, improved work environment, or improved image, e.g., [36,37]. Non-energy benefits have also been suggested as important for making business sense of energy efficiency [38] and to provide economic benefits [12]. However, non-energy benefits can also differ in terms of measurability and may be difficult to include in investment decision-making procedures [39]. Studies in related fields (e.g., environmental and sustainability management control) have addressed the problems of investments involving both qualitative and quantitative information, and the complexities that may arise regarding what information to include and how, as well as the role this information plays in the formal and rationally grounded investment process [22] which often is skewed towards economic impacts rather than sustainability-related impacts [40]. Acknowledging sustainability in decision-making procedures has also been suggested as an important means to achieve sustainability objectives and contribute to sustainable manufacturing [41]. Thus, there are difficulties related to identifying and assessing sustainability impacts, as well as on how to include this information in the activities and procedures of the investment process; difficulties that may lead to sub-optimal decisions [9].

The aim of this paper is therefore to illuminate these difficulties and advance our understanding by exploring the structural context of the investment process for energy efficiency investments, examining the associated activities and procedures, as well as the role of different types of information. This approach enables a comprehensive perspective in which the different levels of decision-making and involvement of various decision-makers are highlighted. This is accomplished through a case study of a major capital investment with adjacent energy and non-energy benefits, undertaken at a company, henceforth Alpha, within the energy-intensive pulp and paper industry (PPI). The investment amounted to about €90 million (The exact sum is not given to ensure anonymity of the case firm) and was necessary for complying with environmental legislation in order to keep their production license. In addition, it was also motivated and justified from a sustainability perspective due to its impact on energy efficiency and emissions. Hence, with its productivity-, energy-, and sustainability-related motives, it provides a complex sustainability investment case for the manufacturing industry.

The study indicates a multistep process in line with previous literature, e.g., [27,29,32,42], but also adds insights into the different stages of the process and the ways in which formal activities and procedures at the authorization stages influence the intermediate investment practices. Investment activities and procedures also appear to influence the way in which an investment is executed and not only whether or not it will be accepted, which emphasizes the role of integrative configurations, e.g., [43], in enabling proactive energy efficiency and/or sustainability investments. Last, ambiguities related to the configuration of investment activities and procedures, which in turn may cause tensions in the investment process with implications for more complex investment cases, are illuminated.

The remainder of the paper is structured as follows. Section 2 presents the theoretical background and previous research. Method and materials are described in Section 3. Section 4 presents the results of the case study which are then discussed further in Section 5. Finally, conclusions, limitations, and suggestions for future research are provided in Section 6.

2. Theoretical Background

Already in his now classic seminal work, Bower [27] noted an emphasis on capital budgeting from conventional finance perspectives in the literature; he highlighted the need to acknowledge investment decision-making as "an integral and inseparable part of the strategic process as it is carried out by the general management hierarchy of the corporation" (p.12), and defined investment decision-making as a general management problem:

"In fact, the set of problems corporations refer to as capital budgeting problems are general management problems. They involve those strategic moves which direct an organization's critical resources toward perceived opportunities in a changing environment. The processes by which resources are committed in turn involve (1) intellectual activities of perception, analysis, and choice which are often subsumed under the rubric "decision-making"; (2) the social process of implementing formulated policies by means of an organizational structure, systems of measurement and allocation, and systems for reward and punishment, and finally (3) the dynamic process of revising policy as changes in organizational resources and the environment change the context of the original policy problem. Management of these processes is a task for general management rather than financial specialists." [27] (pp. 7–8)

However, the financial emphasis in the literature still remains; studies frequently focus on activities related to financial evaluation and applied capital budgeting techniques [44–49], even though it has been indicated that the importance of the financial evaluation may vary depending on, for instance, investment characteristics [50,51]. There is an emphasis on the use of different capital budgeting methods, payback periods, and hurdle rates [52], while the characteristics of the investment process remain overlooked and "black boxed" [31,53]. Financial evaluation is an important constituent of the boundary system of management control systems, i.e., it is a means to limit the opportunity set to ensure resource allocation for appropriate opportunities [28,54]. However, in line with Bower [27], the investment process is a strategic control tool and should be approached beyond applied capital budgeting techniques as well as be treated as an appraisal process in which both financial and non-financial information are considered, together with the associated organizational context [24,32]. This paper builds on this and positions investment decision-making as an element of management control, focusing on the activities and procedures taking place during the investment process and the role of information in this analysis, and its implications for sustainability investments in an industrial setting.

2.1. The Activities and Procedures of the Investment Process

The investment process is in the literature described as an integrated, multistage process involving multiple managers and divisions [24,27,42,50]. Decisions on capital allocation and investment are subject to a high degree of delegation, due to the need for input from lower level employees on local or divisional information [55]. This paper is specifically concerned with the potential implications for complex investment cases which are forced into a predefined investment process and subject to the controls stipulated by their associated activities and procedures. In a sustainability-setting, this entails the ways in which activities and procedures limit or facilitate investments with sustainability impacts which may not easily fit predefined rules and controls. Company procedures can indeed be established in a way that can contribute to sustainable manufacturing [41] and the emerging body of literature on sustainability management control has called for an integrative approach and highlights the need for establishing procedures and implementing activities for integrating sustainability in internal processes, e.g., [43]. Such processes may include policies, environmental investment goals, or integrated environmental criteria in evaluation processes [56,57]. In terms of investment processes, this translates into an integration of such aspects, for example, energy efficiency measurement [58], into the investment process and the associated activities and procedures. Integrating, for example, environmental aspects into capital investment decisions may allow for additional perspectives to be considered [59]. Accounting for environmental aspects in the investment process integrates

environmental issues into management and decision-making, and helps to increase internal visibility, as well as facilitate the adoption of investments which minimize environmental impacts, such as investments aiming to reduce emissions and pollution [60].

In their study on internal capital markets and managerial power, Glaser et al. [53] discuss the capital allocation process in two phases; the planning stage and the execution stage, where actual investments are made at the second stage. This process involves several actors and requirements on investment proposal forms, calculated Net Present Value (NPV), strategic fit, and authorization route. The stages of the investment process have been described in the literature in different yet similar ways, e.g., [25,27,42,50]. One example is provided by Harris [42] (p. 352), which also is adapted by [24], in which the investment process is described as a series of activities in seven stages (but with several feedback loops): Project generation based on ideas and opportunities; business case outlining according to preliminary assumptions; early screening by divisional executive teams; detailed discounted cash flow (DCF) analysis and evaluation; judgement by divisional executive teams; decision by group board; post audit review. Hence, a project passes various steps and managers, i.e., gates [61], where various activities and procedures take place in which different information is assessed and evaluated according to predefined rules [32,42]. Cooremans [50] provides a contribution regarding the investment process for investments which improve energy efficiency, and emphasizes the role of investment characteristics, in particular the strategic character of investments, for the final investment decision. Her study indicates that energy efficiency is only considered moderately or non-strategic, which in turn inhibits the adoption of these investments, hence there is more to investment decision making than the financial evaluation. However, compared to [50], where firms are included from both industrial sectors, e.g., chemical and pharmaceutical industries, and non-industrial sectors, e.g., shopping malls and exhibition centers, this case study focuses solely on the industrial context and the pulp and paper industry.

Based on the discussion above, the activities and procedures of the investment process concern both the required analyses and the process through which investment projects are coordinated and reviewed [28] and are the means through which managers communicate guidelines and exert control over investment projects and the decision-making process to ensure alignment with the company's strategy [28,62]. Differences in these processes have been indicated between industries, for instance, with respect to the role of the investment manual and the extent to which an authorization system is developed [29]. The activities and procedures constituting the formal context provide structure [27] that can facilitate information flows during the investment process [63]. This includes information on the actual investment, as well as the use of investment manuals, which by including information on how to formulate the proposal, the authorization route during the delegated process, responsibilities, analyses, and guidelines for capital budgeting, function as a means of control and standardization [29,30]. The next section is therefore devoted to the role of information in the investment process.

2.2. The Role of Information

During the investment process, information related to a specific investment is assessed and evaluated. Information may play different roles during the investment process that go beyond a limited role as a passive input [64], and the quality of the information used to support an investment project is a factor influencing judgement [28]. Cheng and Mahama [65] studied the role of independent reviewers in relation to company guidelines, finding that investment proposals following these guidelines are evaluated more positively than those deviating from such norms. Thus, capital investments are "sold" based on different types of arguments through a multi-step process [66]. This implies demands on the information used in the investment process, and Hirst and Baxter [64] (pp. 203,204) addressed the examples of "cost savings" and "control of expenditure" as labels that are "*generally valued* in business settings—provides a *common/acceptable* way of thinking about and describing a course of action" (emphasis in original), i.e., that there is a shared language.

From an instrumental perspective, information is used to improve decision quality, i.e., to discriminate between different options and reduce uncertainty [64]. Advancing energy efficiency and sustainability in industry would imply addressing a broad range of potential benefits to acknowledge the different viewpoints of the involved decision-makers, i.e., the non-energy benefits of improving energy efficiency [2], including, for instance, reduced maintenance costs, improved safety, or improved work environment, as well as environmentally-related benefits such as reduced emissions [36,37,39]. Additional examples include improved productivity, increased product output, reduced wear and tear on equipment and machinery, reduced wastewater, reduced hazardous waste, improved air quality, and improved personnel health, but they may, as well as the type of energy saving, differ between contexts and depending on the energy efficiency investment [36]. These benefits have been described as attributes [67], which may lead to an increased adoption rate for such investments by increasing their relative advantage [26]. However, information could also be presented from a strategic perspective, i.e., in a selective fashion to promote both problem definitions and solutions, or have a symbolic role, i.e., when it used for so-called affective outcomes; to enhance an image [64].

Information may also differ depending on the investment and involved managers [25] and in terms of the abstraction level and measurements depending on the phase of the investment process [27]. Although not a study on investment processes, the Jørgensen and Messner [61] study on the relationship between accounting and strategy for a new product development project provides useful insights on the role of information during a decision-making process, relating to formal and informal control mechanisms. Control is described as rather informal between the different stages of the (new product development) process, i.e., general and practical understanding, experiences, and allowing for various alternatives [61]. However, to continue to the next stage of the process, i.e., to pass the gate, formal control is required at the gates, which is achieved through top management defined criteria, key financial indicators, and other relevant information, discussed with the management board. This also influences the more informal process during the stages, since coordination is required in order to ultimately pass the upcoming gates [61]. One example of this from the empirical case presented in [61] (p. 198) is how engineers, whose main concern is to develop technical solutions, try to relate solutions to costs and revenues. Hence, there is a formal process in order to ensure alignment with strategic goals, e.g., [28], at play at the gates for the different process stages, but it is also influential for what takes place in between [61].

This should ultimately also influence the way in which information is presented and assessed through the activities and procedures of an investment process. In line with the aim of this paper, it is important to consider the consequences this may imply for energy efficiency or sustainability-related investments, since sustainability-related information may be difficult to acknowledge in traditional investment processes [9]. It also relates to the addressed questions on what information to include and how, and the role of information during the investment process [22,64], between and at the gates of the different stages.

To summarize, the way in which information is communicated and presented is important for the outcome of the investment process, which calls for an enhanced understanding of the way in which sustainability-related information is addressed in the activities and procedures of the investment process. Internal processes should be developed for sustainability-related information [20] and preferably be integrated with conventional activities and procedures to overcome cognitive barriers and enable more well-informed decision-making [43,68]. Therefore, through a case study of a complex investment with productivity, energy efficiency, and sustainability motives, this paper seeks to contribute both practical and theoretical insights regarding investment decision-making practices [23,52], that may in turn contribute to improve energy efficiency and sustainable manufacturing. Through its use of energy and other resources, the operations of an industrial company are directly connected to their carbon footprint [7] and including energy efficiency in management processes is a crucial step to increase awareness and improve industrial energy efficiency and sustainable development [58].

3. Materials and Methods

In their review of capital budgeting research, Clancy and Collins [52] call for case studies of actual decision-making practices; a call to which this study responds. This research was performed through a single case study with the management control activities, procedures, and information of the investment process as units of analysis. Despite their context dependency, single case studies can provide in-depth insights and a more nuanced view of a research phenomenon [69] as case studies enable a holistic view and "as a research endeavor, the case study contributes uniquely to our knowledge of individual, organizational, social, and political phenomena" [70] (p. 63).

3.1. Sampling: The Case Investment and the Case Company

This study has been executed by analyzing an investment case at a pulp and paper company. The investment decision was announced publicly in late 2011:

> "*The Company Board of Alpha has made the decision to undertake an environmental and energy investment at Alpha Mill. The aim is to strengthen the mill for the future by improving environmental performance and energy efficiency as well as enabling for future expansion. The expected investment amount is €90 million*." (Press release for the case investment, 2011. The quote has been somewhat modified to ensure anonymity of the case firm.)

The case investment was initiated due to environmental compliance requirements that were necessary to keep the production permit. However, it was also motivated and justified based on sustainability arguments, in particular improved energy efficiency. The case investment could thus be described as a major, complex investment, amounting to almost €90 million, which was strategically important for future production. The investment consisted of a new evaporation plant and an upgraded recovery boiler, which are essential in the production process of pulp, and had, at the study's initiation, been installed and implemented for approximately one year. Due to its complex character in terms of varying motives and broad impacts, this case can provide insights into the decision-making practices related to capital investments and the way in which complex investment cases are enabled or limited by the structural context of the investment process. Hence, this case investment provides the opportunity to explore a significant phenomenon in detail [71]. Consequently, this case study seeks to both describe an intervention, the case investment, as well as to explore the situation, the investment process, in which this intervention has taken place [72] by focusing on its management control activities, procedures, and information.

The case company Alpha is a large group in the Swedish PPI, with a yearly turnover of about €2.5 billion, with several mills, i.e., units, in Sweden and abroad. Alpha is a PPI company producing paper, board, and pulp products. The company has a strong sustainability profile, is certified according to several standards, including ISO 14001 and ISO 50001, and participated in the program for improving energy efficiency in energy-intensive industries (PFE), which was a voluntary long-term agreement provided by the Swedish Energy Agency [73].

Due to the electricity intensity of the production process, energy is a large cost for PPI companies, which is why reducing energy use is a prioritized issue for this industry [74]. This is also important from a sustainability perspective. On a national level, the Swedish PPI accounts for half of the Swedish industry's total energy use [73] and Alpha alone has a yearly energy use of over 15000 GWh. Furthermore, adopting energy efficiency measures has been suggested as both cost effective and beneficial for reducing energy use and emissions in the PPI [75–77], which emphasizes the role of investments such as the case investment.

3.2. Data Collection and Analysis

Having multiple data sources is an advantage of case studies [72,78]. Data collection (Table 1) was based on 10 semi-structured interviews conducted during spring 2015 and additional data sources in the form of internal and external documents, including templates for investment applications and

risk analysis applications, press releases, financial reports, sustainability reports, and an information meeting and mill tour, which initiated data collection.

Table 1. Data sources.

Data Source	Description
Interviews	Ten in total, two at group level and eight at mill level. Eight interviews conducted face-to-face, two by phone. See Table 2 for interviewee descriptions.
Information meeting	Introductory meeting with the division manager. Presentation of the unit and its operations. Notes.
Mill tour	By Division Manager in connection with the information meeting.
Financial and sustainability reports	External documents, publicly available.
Press releases	For the case investment and other sustainability-related investments. External documents, publicly available.
Template for investment application	Three-page form stipulating the requirements for the investment application. Internal document. Received copy.
Template for environmental analysis	Two-page form stipulating required information on environmental impact. Internal document. Received copy.
Template for risk analysis	Internal program and document. Restricted to observe on site and take notes.
Presentation of case investment	Presentation of the results of the case investment, approximately one year after implementation. Internal document. Received copy.

Two interviews were performed at the group level and eight at the mill where the case investment was implemented. The interviewees were involved to varying degrees and in different ways in the investment process (described in Table 2). This approach is motivated from two perspectives. First, investment decision-making is often delegated. It has therefore been advocated for empirical studies to take a bottom-up approach and include actors from lower levels in the organization and not only Chief Executive Officers (CEOs) or Chief Financial Officers (CFOs) [55]. Second, the way in which industrial sustainability aspects, for example energy efficiency, are perceived has been indicated to differ between different decision-makers [2], such as financial managers and energy managers [50]. Hence, the choice of interviewees was motivated based on their varying roles and perspectives in the investment process.

Table 2. Interviewee descriptions.

Interviewee	Description	Organizational Level
Sustainability Director	Part of executive management. Responsible for sustainability issues at the group level. Was also at the time communications director at the group level (i.e., combined role).	Group
Investment Coordinator	Coordinator of major investment applications at the group level. Part of investment committee at the group level.	Group
Department Manager	Head of Pulp Department with operational responsibility for its processes. Part of management board and energy steering committee at the mill.	Mill
Environmental Manager	Department manager for process development and environmental issues. Overall responsibility for energy issues. Part of mill's and its subdivisions' energy committees.	Mill
Division Manager	Division manager for a subdivision of the sulphate pulp mill, including the case investment. Responsible for continuous improvements in energy and in general for the division. Was involved during the process for the case investment as project leader for the evaporation plant.	Mill
Investments Manager	Coordinating role at the mill for investment planning. Reviews investment applications requiring approval at group level. Was main project manager for the case investment.	Mill
Financial Manager	Head of Financial Department and part of the mill's management board. Reviews investment applications before submission to management board.	Mill
Maintenance Manager	Head of Maintenance Department at the mill. Administers and is responsible for prioritizing between investments. Part of the mill's management board. Manager of committee with all maintenance managers within the company group.	Mill
Technical Controller	Works with energy and environmental issues, including budgeting, reporting, and coordinating. Reviews investment applications before submission to the mill's management board. Part of the energy steering committee at the mill and energy council on group level.	Mill
Manager Health, safety & environment (HSE)	Head of work environment and safety at the mill. Part of the group-level work environment committee.	Mill

The division manager was the first contact. The other interviewees were identified during the data collection process due to their role in the investment process and the case investment, or involvement with sustainability issues, such as the Group Sustainability Director. Three of the interviewees—the environmental manager, the division manager, and the investment manager—are considered key informants on the case investment. During the investment process, the investment manager was the responsible project manager for the investment project, but it was at the time of the interviews, i.e., after implementation, under the responsibility of the division manager. The environmental manager is considered a key informant due to the environmental compliance prompting the investment.

The interviews were based on a semi-structured interview guide with open-ended questions. The questions addressed the investment process in general, such as actors involved, steps of the process, activities, procedures, information, and so forth, and related to the case investment. In addition to questions on activities and procedures for the investment process, it also included questions regarding motives and strategic support for improving energy efficiency, and the way in which non-energy benefits were accounted for; i.e., measurement, monetization, and so forth.

All interviews were recorded, transcribed, and supported by notes during the interviews. Initially, attribute codes [79] were assigned to the participants, including title, role description, place of work (mill or group level), and interview details. The verbatim transcripts and documentation were analyzed for each interview and at an aggregated level to account for the perspectives of each participant and of all participants [80]. The analysis was made both for the investment process and its structural context for the mill, i.e., on an organizational level, and for the investment. The first step was to identify the stages of the investment process and for the case investment to chronologically compile the events leading up to the decision. This approach had both a descriptive and analytical purpose [72]; it enabled an identification of the activities and procedures of the process, and it also included an analysis of the activities, responsible persons, and their assigned tasks at each stage and between stages. This was followed by a more thorough analysis of the activities and procedures, and different types of information used in the investment process. The interviewees were given the opportunity to review the results to strengthen validity and reliability [72].

4. Results

This section presents the results from the case study, based on the interviews and additional data sources. The analysis is divided into the three main concepts guiding this paper: Activities, procedures, and the role of information. The case investment provides a unique example of a major, complex investment motivated by rational, strategic, and sustainability grounds. The empirical analysis indicates how all investments at Alpha are subject to the same formal process, which emphasizes the need for adequate activities and procedures to enable the integration of sustainability-related aspects into the investment process. However, it also points to the dual role of investment activities and procedures; besides their enabling role, they also appear to limit information assessment and analysis due to requirements inherent in the authorization process. The section ends by providing new insights into the relationship between energy efficiency and non-energy benefits and the ambiguity this implies for the investment process.

4.1. Activities

> "*No, we have a standardized method for how this should be done. Whether it is environmentally related, production or energy . . .* " (Technical Controller, Alpha Mill)

> "*It is the same template regardless of what it is.*" (Department Manager, Alpha Mill)

These quotes confirm the proposition in the introduction: Investment decisions are made within a structural context, subject to predefined rules. The investment process (Figure 1) was identified as a series of activities, involving multiple actors, and taking place both at the mill and the group level. However, there are also activities outside the investment process which are crucial for what the

company could do in terms of investments. First, the investment process is subject to a set of boundaries providing the limits for what Alpha could do through investments. This includes internal limits such as strategic goals, their long-term investment plan, budget funding, and investment classification, i.e., which types of investments should be undertaken and the means available for them—what they can do. This also includes more short-term prioritization between investment projects. For investments within the mill's own investment budget, maintaining production, discussed as 'availability' (of production), was the most prioritized issue.

> "*Most investment projects are connected to availability and what needs to be fixed in order to maintain or improve the availability.*" (Maintenance Manager, Alpha Mill)

> "*At the mill level, there are few improvements you can do. You have to prioritize between the opportunities you have and the necessary investments you have to go through with.*" (Investment Coordinator, Alpha Group)

Company level & Involved actor(s)/ Function(s) / Stage in investment process	*Mill* Project manager & client, operations, maintenance, HSE, and environmental functions, technical consultants.	*Mill* Project manager & client, project group, suppliers.	*Mill* Project manager & client, project group, investment manager, financial manager, department manager.	*Mill* Project manager & client, environmental, technical, and financial functions, investment manager, management board.	*Group* Investment coordinator, investment committee, group executive board. (Company board)	*Mill* Project manager
1. Initiation	Identified need.					
2. Pilot studies	Evaluation of possible solutions.					
3. Pre-project	Detailed evaluation of one solution.	Tender negotiations with suppliers.	Development of project report and investment application.			
4. Evaluation & decision				Evaluation and revision of investment application. **Formal decision by management board.**	Evaluation process with investment committee. Presentation to and **formal decision by group executive board.**	
5. Implementation & Post-audit						Installation, follow-up and Investment report

Figure 1. The investment process at Alpha mill.

Profitability was another key aspect which influenced investment authorizations, particularly at the mill level:

> "*There is probably no investment with a payback period of more than 2 years that is approved within the mill's investment budget.*" (Department Manager, Alpha Mill)

Alpha also operates subject to legislation and regulations, for example regarding emissions, which form external limits stipulating what they are legally required to do. Together, these internal and external limits constitute the prerequisites for the company's investment process.

Figure 1 intends to visualize the activities of the investment process. All projects have an overall project manager and a project client. The project manager has an operative and coordinating role, while the project client is the "owner" of the project and is responsible for reviewing project-related material, such as the pre-project report. For larger investments requiring approval at the group level, the project client is usually a department manager or similar, and part of the management board at the mill. It may also be a division manager, for example, someone responsible for a paper machine or another subdivision at the plant. He or she also functions as a gate between the stages as described by the department manager:

> "*It can be to take the decision to make the pre-study, and should we proceed and also do a pre-project and feasibility study? Should we develop an investment application? Then I am also part of the management board which acts as a tollgate, where we decide whether we should make an investment.*"
>
> (Department Manager, Alpha Mill)

In addition to the project manager and client, a number of actors and functions are involved during each stage of the process. After the initiation stage and the following pilot study, a detailed pre-project is conducted in which several functions are involved, including, for example, maintenance and the environmental department. At this stage, tender negotiations with suppliers also take place, since "hard" numbers are required for the investment application. A project report is developed, and if decided, an investment application is prepared for the management board. Before the application is sent for decision by the management board, approval by the environmental, technical, and financial departments is required. Smaller investments within the mill's investment budget are authorized by the management board. Larger investment projects require authorization at the group level, and in some cases also at the company board level. These investment applications are also reviewed at the mill level by the investment manager before proceeding to the investment coordinator and investment committee, who process the application before it is reviewed by the group's executive board for a final decision. If the investment is approved and implemented, a post-audit follows, concluded by a final report from the project manager at the mill. Hence, the investment process is a process taking place on multiple levels, both at the operational and strategic levels at the mill, as well as at the group level. However, it is in most cases a bottom-up process and the groundwork is conducted at the mills.

The case investment was publicly announced in late 2011. Before undertaking the investment, the production license was threatened since the recovery boiler's dust emissions exceeded the Integrated Pollution Prevention and Control (IPPC) directive's requirement at the time, which aimed to minimize industrial-related emissions across the EU [81] (Directive 2008/1/EC. It was repealed by the Industrial Emissions Directive (IED) (Directive 2010/75/EU) in 2014 [82]). Therefore, the authorization of the case investment was an exceptional example since it was a strategic investment necessary for the survival of the mill, and thus a group-level decision from the beginning. However, the way in which it should be executed was not fully detailed; this was delegated to the mill and dealt with following the mandatory activities (Figure 1) associated with the pre-project and feasibility studies, approved financial calculations, and so forth. For the case investment the project manager was the manager who at the time of the interviews held the position as investment manager at the mill. Although the formal decision was taken in 2011, internal discussions and sets of pre-studies had taken place earlier (1997, 2004, 2008). A pre-project and feasibility study took place during October 2010–May 2011. This also included negotiations with suppliers, as described in Figure 1.

> "*We had already negotiated with the suppliers so the day we got the authorization we could sign the contracts and start.*" (Investment Manager, Alpha Mill)

Installation and start-up of the new evaporation plant took place during spring 2013, followed by the rebuilding of the recovery boiler. The investment project was then completed at the start-up of the recovery boiler and the resumption of production, fall 2013.

4.2. Procedures

Whereas the preceding section delineated the activities of the investment process, this section seeks to examine the procedures which stipulate how these activities should be carried out and the applied rules and controls, and the extent to which these procedures may provide beneficial conditions for acknowledging sustainability during the investment process. Various procedures could be identified for the investment process at Alpha, which are presented in Table 3. The levels and activities associated with each procedure in the investment process are indicated in the table. Together with the activities of Figure 1, the procedures in Table 3 indicate several management control activities and procedures at play. Investment proposals travel through the organization according to a predetermined route, passing through multiple groups, committees, and departments (e.g., the technical, environmental, and financial departments) where they are reviewed, ranked, and formally authorized.

Table 3 indicates differences attributable to the size of the investment, for example regarding financial evaluation. For larger investments, financial evaluation was based on other measures besides the payback period (financial evaluation A). Some (larger) investments could also have other motives that made the financial evaluation less significant, e.g., the case investment, as long as they could bear their own costs.

The case investment was classified as a strategic investment (investment classification A, Table 3) since it was a prerequisite for prolonging the production permit and ensuring the survival of the mill. However, the case investment was motivated, as well as justified, based on industrial sustainability rationales, which in turn appear to be facilitated through integrative elements in the configuration of the activities and procedures. For instance, it was stipulated through investment routines that energy impact should always be accounted for (Table 3), even when the main investment aim was not energy related. Methods such as Life Cycle Cost (LCC) were sometimes also applied. The case investment was identified by the interviewees as an instance when these routines had made a difference. Despite its mandatory nature, additional measures were taken to justify the case investment further, especially with respect to improving energy efficiency, since the current level was below the industry standard. The more energy efficient option was therefore chosen because of the potential for future savings related to maintenance and energy costs, even though it could have been implemented in a less extensive form:

> "*It was a mandatory investment, but we chose to be proactive.*" (Investment Manager, Alpha Mill)

The investment process also includes several requirements regarding documentation, methods, reports, and analysis. Risk assessment is a group level mandatory supplement and concerns the risk for disruption in production, i.e., the risk of not being able to maintain production if the investment is not implemented; i.e., if the company does not proceed with the investment, what is the potential consequence, in terms of likelihood and cost. This includes costs for the production stop, time span, and cost for repairing or investing in new equipment in case of a breakdown, and risk for personnel injuries. It also includes a time horizon for when something is expected to happen, indicating the level of urgency in making a new investment. The investment manual (Table 4), additional documentation (environmental analysis, risk assessment, etc.), and the application form were described as critical during the investment process, especially for larger investments requiring review at the group level:

> "*It really has to go by the technical department so that they can sign. If it is estimated to have an environmental impact, be it air, water, chemicals, etc., then the environmental department must comment as well, and then it should pass the financial department and I should put my signature on it.—It is governed through an instruction exactly the way in which it should proceed.—It should be a project manager and so forth. It doesn't matter (what it is), it is still money that is going out.*" (Financial Manager, Alpha Mill)

> "*You have to have a process where it is fundamental that those responsible for the company's finances say yes or no.*" (Sustainability Director, Alpha Group)

Table 3. Identified investment procedures.

Procedures		Level	Activity in Investment Process
Investment classification A†	Maintain, strategic, enhance.	Group	Investment application
Investment classification B	Strategic, market, mandatory, capacity, quality, rationalization, building, environment, replacement. Multiple classifications possible.	Mill	Investment application
Financial evaluation A	Primarily Net Present Value (NPV), Internal Rate of Return (IRR), Modified IRR (MIRR), payback (PB), occasionally Life Cycle Cost (LCC). Firm-specific discount rate.	Group	Pilot studies, pre-project, investment application
Financial evaluation B	Often limited to PB. Occasionally LCC.	Mill	Pilot studies, pre-project, investment application
Investment committee review	Committee reviewing larger investment proposals before authorization by group management. Structure for revision of proposals before being sent for authorization.	Group	Evaluation and decision
Investment proposal review	Finance, technology, process, environment, management. Who and when stated in the manual.	Mill	Evaluation and decision
Authorization by group management	Group management accepts or dismisses investment proposals, based on investment committee review.	Group	Evaluation and decision
Ranking/investment prioritization A	Prioritization of larger investments administered by mill manager.	Mill	Evaluation and decision
Ranking/investment prioritization B	Investments within the mill's investment budget, administered by maintenance manager. Based on ranking from division managers.	Mill	Evaluation and decision
Authorization limits	Division/mill/investment committee and group management/executive board.	Group, mill	Evaluation and decision
Investment manual	Application (motive, time frame and plan, financial details), authorization route.	Group, mill	Pre-project, evaluation and decision
Environmental analysis	Mandatory supplement to the investment manual, concerning external environment. Limits on emissions, noise, etc.	Mill	Pre-project, evaluation and decision
Risk assessment	Mandatory supplement to the investment manual.	Mill	Pre-project, evaluation and decision
Work environment analysis	Supplement to investment manual. Not mandatory, but representatives from work environment and safety should be consulted for all projects. Work environmental aspects should be addressed in the appendix or proposal.	Mill	Pre-project, evaluation and decision
Energy	Energy should be acknowledged for all investments and upgrades.	Mill	Pre-project, investment application
Supplier involvement	Tenders required at the pre-project stage.	Mill	Pre-project
Documentation routines A	According to the manual and additional pre-project report, presentation to the investment committee, and occasionally executive board.	Group, mill	Pre-project, evaluation and decision
Documentation routines B	According to the manual and additional pre-project report.	Mill	Pre-project, evaluation and decision

† Procedures notated with "A" and "B" varied depending on investment size (A: Large investments, B: Smaller investments authorized within the mill's budget).

Table 4. Content of investment application.

Front cover	Summary, main purpose, key financial figures, authorization signatures.
Background	Commercial, strategic, technical.
Motive	Business impact, secondary motives.
Project description	Goal, scope, boundaries, organization, time plan, risk analysis, alternative solutions.
Project costs	Investment amount, cash out plan, direct costs, production losses.
Financial justification	Assumptions, profitability calculation, sensitivity analysis.
Appendices	Pre-project report, presentation, environmental analysis, risk assessment.

The investment manual includes guidelines for coordination and authorization. Reconnecting to the investment process structure, the pre-project report forms the basis of the application, which implies that most resources are devoted to the early stages of analysis.

Figure 1 indicated that the decision-making process is, to a large extent, delegated to the mills in multiple steps. The process and its activities and procedures (Table 3) indicate that an investment is authorized at several instances during the investment process before the formal decision is taken by the management board at the mill, and/or by the group's executive board. This includes authorization from the project client (for example to conduct a pre-project) but also authorization from, for example, the environmental department. The project and its application go back and forth between different functions and is reviewed on multiple occasions before being presented to the management board; i.e., it is a process in which the investment project in some sense is approved along the way, as was also discussed by the Investment Coordinator:

> "*It is a somewhat iterative process. It starts with an idea and the closer you get with the pre-studies and pre-project, you start to see 'will this make it?' Once you have the final numbers in your hand it is rarely a no.*" (Investment Coordinator, Alpha Group)

Hence, the possibility of a project being rejected diminishes at each stage in the process. If a project "fails," it is usually at an earlier stage, such as during the pre-project, or if it is not possible within the overall investment plan. This further emphasizes the role of the investment manual and other procedures and the way in which these should be followed for each activity in order for an investment to proceed in the process. In particular, it renders the importance of formal consideration of sustainability aspects, e.g., energy efficiency and emissions, or method such as LCC, in investment activities and procedures to enable for investments that can contribute to sustainable manufacturing. Hence, for an investment to make business sense goes beyond short payback periods.

4.3. The Role of Information

Previous studies have indicated that the use and roles of different types of information may shift during the investment process [22], as also indicated in the above quote by the investment coordinator. With its activities and procedures, the structural context of the investment process facilitates the incorporation of different types of information related to the investment. The role of the investment manual discussed above also illustrates how integration in procedures can enable sustainability-related aspects to be considered; it facilitated the proactive execution of the case investment:

> "*Since you ensure you have certain standard processes and standard documents, it forces you to reflect.*" (Financial Manager, Alpha Mill)

The activities and procedures thus enable different types of information to be included; quantitative and monetized information through the financial evaluation and investment application (Figure 1; Table 3), and additional information, such as environmentally-related information (e.g., emissions), through different appendices (Table 4). It was also described how intangible values could be addressed in writing, for example via project description. This included social aspects related to, for instance, occupational health and safety aspects, for which no formal indicators were used by Alpha. These aspects were instead described qualitatively.

As described earlier, the case investment provides a rich, complex example of an investment motivated and justified based on diverse arguments. Ultimately, the case investment was initiated due to environmental compliance requirements which were necessary to keep the plant's production license, but it also aimed to and resulted in increased production, removed bottlenecks, reduced maintenance costs, and, in particular, improved energy efficiency. The impacts of the case investment are summarized in Table 5 below. Measurement and the way in which different types of information (i.e., energy efficiency, non-energy benefits, etc.) were considered in the investment process were also discussed with the interviewees.

Table 5. Impacts from the case investment.

Impact	Cost (C)/Revenue (R)	Comment
Reduced dust emissions	R	Main objective of the investment.
Increased energy efficiency	C	-
Increased productivity	R	-
Increased production	R	-
Increased capacity	R	-
Increased production reliability	C	One less production stop per year.
Prolonged lifetime of equipment	C	-
Reduced material costs	C	-
Reduced use of raw materials	C/R	C: Reduced costs for bark and oil, R: Possibility to sell bark.
Reduced need for maintenance	C	-
Reduced water consumption	C	Not included in the application.
Need for cooling	C	Negative impact, resulted in increased costs.
Improved work environment	n/a	Not included in the application.
Reduced need for engineering control	n/a	-
Reduced wastewater	C	-
Reduced internal and external noise	n/a	Not included in the application.
Improved temperature control	n/a	Not included in the application.
Improved air quality	n/a	Not included in the application.
Improved lighting	n/a	Not included in the application.
Waste fuel	C	-
Worker morale	n/a	Not included in the application.
Other emissions (CO_2, SOx, NOx)	n/a	No change in CO_2 or SOx. Difficulties retaining NOx levels (negative).
Improved public image	R	Not included in the application.

The discussion with the interviewees indicated an ambiguity in how information was included and presented in investment proposals. The pre-project was acknowledged as the stage at which aspects and benefits were first addressed and the most important stage to be included in financial assessment; the larger the investment, the broader the scope and the more detailed the pre-project, and more aspects could be considered. However, at the same time, simplicity and clarity and an emphasis on the investment's main motive were highlighted as important for proposals requiring review and authorization at the group level. The investment manager, for instance, argued for investment motives in proposals:

> "*Those who make the decision need to know why you want to do this.—So, it is the motive. It rarely fails based on technology and the level of detail.*" (Investment Manager, Alpha Mill)

Hence, within the structural context of the investment process, there is an ambiguity regarding the broader scope required to facilitate more information and more extensive analysis, while also having stricter requirements in terms of focus and level of detail.

The case investment provided several examples of aspects that were left out of the application, following this ambiguous reasoning. Several qualitative, intangible benefits were observable, such as improved work environment and improved lighting, but many of these were not thoroughly included beforehand (see Table 5 for more examples). An improved work environment was anticipated beforehand but was only briefly mentioned in the proposal:

> "*This was a typical case of 'we mention it but we don't bother pushing for it'—But work environment is a considerable change.*" (Investment Manager, Alpha Mill)

An important implication for sustainability-related investments, or investments with sustainability impacts, is that although a benefit may be substantial, there is no guarantee that it will be included or addressed at length, especially if it is not easily quantified. This may have the implication that non-energy benefits relating to the social dimension of sustainable manufacturing could be neglected during the investment process.

4.4. A Note on Energy Efficiency and Non-Energy Benefits

The discussion on the emphasis on motives and main effects, rather than all possible effects, provided insights which complicated the picture of the investment process for investments improving energy efficiency. In the literature, non-energy benefits are positioned as additional benefits to energy savings [36,37,39]. In this case study, a reversed relationship instead became evident, where additional benefits often were the main cause for an investment and energy savings were an additional benefit, as in the case investment:

> "*Maybe you install new equipment to increase production and then you end up improving energy efficiency as well. So it is not always that you aim to save energy and increase production, it is more often the other way around.*" (Technical Controller, Alpha Mill)

> "*Increased productivity, improved quality, reliability in production . . . This is why we wish to make certain investments.*" (Financial Manager, Alpha Mill)

That energy efficiency in some sense was often a secondary benefit also came through in the discussion on prioritization. Due to its cost impact, improving energy efficiency is a strategic action in an energy-intensive industry such as the PPI. Improving energy efficiency could be motivated from various perspectives, such as improving sustainability by reducing fossil fuel dependence (technical controller, Alpha Mill), or through its cost savings:

> "*An energy efficiency investment is an environmental action that pays off.*" (Investment Manager, Alpha Mill)

> "*Energy is such a big question for us. It's a lot bigger than environment and sustainability. For us, energy is such a large cost, so there is a driving force for that (energy) work.*" (Environmental Manager, Alpha Mill)

> "*Energy is one of the resources we use but then it also costs a lot of money too—it happens to go hand in hand.*" (Sustainability Director, Alpha Group)

However, although it could lead to significant cost savings for a PPI company such as Alpha, improving energy efficiency could still be low in priority:

> "*The most critical issues need to be prioritized within the mill's investment budget, which often implies investments in production, availability or maintenance.—energy efficiency is 'just money,' whereas for example investments in production have a shorter payback period and an operational focus.*" (Division Manager, Alpha Mill)

This indicates that while the configuration of the activities and procedures at Alpha have integrative elements in which it is stipulated that energy efficiency and environmental aspects should be accounted for, there are other, contrasting requirements such as simplicity as well as aspects related to prioritization which works in the opposite way. Hence, the activities and procedures both enable and limit investments that do not fit the predefined structural context, such as energy efficiency and other sustainability-related investments.

5. Discussion

To respond to recent calls in the literature [22,23,52] this paper has sought to address investment decision-making from a management control perspective, which, despite being advocated for a long time [27], remains overlooked [32,52,83]. The paper has been specifically concerned with the structural context of the investment process and the way in which it enables or limits sustainability investments that to some extent deviate from the predefined structure. The paper has revolved around three main concepts: Activities, procedures, and information. The case study indicated a process in which multiple decision-makers and functions were involved in investment activities. Although some had energy issues included in their role descriptions, others were concerned with other perspectives of industrial sustainability [2], such as the environmental and HSE managers (Table 2), and others provide a management perspective at the mill and the group level.

A substantial part of the investment process is delegated to the mills, even for larger investments that are formally authorized at the group level. There are formal requirements at the gates [61] with specific requirements in terms of documents (e.g., pre-project report, investment application, environmental analysis, presentation for group executive board, etc.) and review (e.g., project client, management board, etc.). However, the formal nature of the investment process is also evident between the gates since procedures at the gates highly influence the information and the activities taking place in between [61]. For example, before an investment application is presented to the management board (i.e., a gate), it must first pass the environmental, technical, and financial departments for review (Figure 1; Table 3), which impacts the work between the pre-project stage and the submission stage of the investment application. Hence, the formal process with its predefined activities and procedures provides guidance and direction for the lower levels on what should be emphasized [27,28] and enables a standardized investment process [29]. The steps of investment process illustrated in Figure 1 are much in line with processes that have been indicated elsewhere [42,50]. As also indicated by the empirical findings, energy efficiency investments are subject to the same investment processes as all other types of investments.

For energy efficiency and sustainability-related investments, this makes the activities and procedures of the investment process crucial for the way in which sustainability-related information (including energy and certain non-energy benefits) can be integrated into the decision-making process, which in turn has been acknowledged as a prerequisite for sustainable development in organizations [20,43] as well as an contributor for sustainable manufacturing [41]. As also described by the financial manager, since it was stipulated in the investment manual that energy as well as other environmental aspects should be acknowledged (see Tables 3 and 4), it has been made a criterion for evaluation during the investment process. This encouraged reflection on aspects that would otherwise be at risk of being overlooked. Hence, there are incidences of integration in the investment activities and procedures, enabling an assessment of sustainability-related information as well as creating awareness. This is essential in the quest for cognitive integration of sustainability in organizations [43], since several of those involved in the investment process tend to have their main focus elsewhere [2]. However, the case analysis also indicates how most procedures are established at later stages and the decision-making takes place at the strategic levels (e.g., investment application, evaluation, and decision, see Table 3). This calls for the development of activities and procedures, such as measurement methods [39,58], to enable integration and increase awareness throughout all organizational levels, including operational levels which are highly involved during pilot studies, pre-project, and feasibility studies.

The findings also add insights into the role of the activities and procedures for the execution of an investment, and not just for whether or not it is adopted. The case investment provided a unique example of a strategic, rationally motivated investment with ample sustainability and energy-related benefits as well. In external communications (e.g., press releases) it was also communicated as an investment for improving energy efficiency and environmental performance, and *additionally* also upgrading the production facility. However, it was an investment necessary for the mill's survival,

which implied that the investment, in a sense, was authorized from the beginning. Yet, its technical specifications and details were delegated to the mill, and the development of the investment project was required to follow the same steps and review procedures as all investment projects. This further strengthens the role of guidelines in reaching affirmative investment decisions [65], and the role of internal processes in integrating sustainability aspects as well as the need for developing processes that enable such integration [20], since this could plausibly encourage the development of more sustainable and proactive solutions. One fundamental implication from this is for (sustainability) investments to make business sense constitutes more than payback periods and financial evaluation; the structural context, comprising decision-making, activities, and procedures, must be considered.

That different functions, such as the environmental and health, safety and environment (HSE) functions, should be addressed (Table 3) may also enable qualitative information to be acknowledged and prioritized, such as improved work environment. Compared to Vesty et al. [22], this case study did not indicate any pattern in the role of qualitative and financial information over time in the investment process. However, that the environmental department and HSE representatives should be included at an early stage, as well as reviews of the investment application, could possibly be interpreted as qualitative information acting as early gates in the investment process, in line with Vesty et al. [22] (for example, if the investment threatens workplace safety, it will not be analyzed further). Still, it should also be emphasized that financial assessments are required for each investment project already at the stage of pilot studies. Moreover, potential cost savings constituted the main motive for energy efficiency investments, which also implies a focus on quantitative information.

Based on the discussion above, the investment activities and procedures used at Alpha appear to hold favorable conditions and requirements for an extensive assessment and analysis of information that also enable integration of sustainability-related benefits into the investment process. However, the analysis also indicates ambiguities related to the role of information and the configuration of investment activities and procedures. In particular, for larger investments requiring authorization at the group level, there was an emphasis on motives and main effects when preparing the investment application. This was a plausible consequence of the need for coordination and control in a delegated investment process [27,29], which influenced the extent to which certain information was accounted for. It was, for example, indicated that some expected effects were excluded from the investment application for the case investment and were saved for later opportunities, even though they were expected to have a positive impact.

Hence, there is an ambiguity stemming from the simultaneous broad scope that should facilitate more information and extensive analysis, while also having more rigorous requirements in terms of focus and level of detail, i.e., information has both an instrumental and a strategic role [64]. Two possible implications for investment control and energy efficiency investments arise from this. First, acknowledging the instrumental role of information can enable a more well-informed decision-making process for sustainability-related investments, for example by expressing and including benefits in line with common business case arguments [84] by the means of developed measurement methods and quantification of both energy and non-energy benefits [37,58]. Second, the strategic role of information implies an increased importance of seeking alignment with strategic goals. These opposing practices may however, in particular for complex investments with broad impacts and motives, cause tensions in the investment process, as the last stages and the strategic role of information place higher demands on simplicity and alignment. This puts pressure on the configuration of investment activities and procedures to comply to these demands while also enabling for all relevant information, including sustainability-related, to be acknowledged. This would include both improved strategic controls, e.g., investment planning, and integration in investment guidelines and manuals. For sustainability-related investments, this emphasizes the need to have formulated sustainability goals and strategies to increase priorities and enable intangible sustainability aspects to be accounted for during the investment process.

To conclude, this case study's findings are in line with the previous capital investment process literature with its findings of a formal process in place and the role of the structural context [24,27,29,30]. The findings indicate that all investments, irrespective of category, are subject to the same process and controls, but with some differences based on the investment amount. However, this paper also adds to the literature by illuminating ambiguities related to the configuration of investment activities and procedures, which in turn may also cause tensions in the investment process, with implications for the way in which sustainability aspects can be considered.

Another finding arising from the case study concerning the configuration of activities and procedures relates to energy and non-energy benefits, and the way in which energy efficiency improvements were often considered the additional benefit, and not the other way around as it is often defined in previous research, e.g., [37]. Energy efficiency is characterized by heterogeneity, and investments in energy efficiency range from small production improvements to large-scale investments [26], such as in the case investment. Therefore, the way in which energy efficiency is accounted for also varies. It is impossible to neglect the case investment's strategic importance and that its magnitude enabled for energy efficiency and environmental improvements to be implemented. For investments lacking such support, passing the stages of the investment process might not be as straightforward. Due to its cost impact, improving energy efficiency is a strategic action in an energy-intensive industry such as the PPI. However, and as discussed previously, it may still stand back due to more prioritized investments in production to maintain availability [19], and the limits of the investment plan, especially for smaller investments.

6. Conclusions

This paper has studied the structural context of the investment decision-making process through a case study in the Swedish PPI. In so doing, the paper has sought to contribute to our understanding of how to make business sense of sustainability, in this case through the example of a large and complex energy efficiency investment. The paper adds to the literature by illuminating ambiguities related to the configuration of investment activities and procedures, which in turn may cause tensions in the investment process, with implications for more complex sustainability-related investment cases. It indicates the importance of acknowledging the structural context of investment decision-making processes, and not only focusing on financial evaluation. With its more comprehensive perspective, the paper adds to the development of our understanding of "the rich tapestry that surrounds capital budgeting processes and investment appraisal" [23] (p. 724) and how companies make decisions related to capital investments [23,52,53,55] improving sustainability [9], as has been called for [22]. The findings identify a delegated multistep process subject to predefined controls, and an established authorization route involving multiple decision-makers, in line with previous literature [27,29,32,55]. The study also adds insights into the way in which the investment process has several gates, whose formal procedures influence the role of information in the activities and procedures taking place in between [61].

In a previous study, Cagno et al. [2] approached energy efficiency improvement as an industrial sustainability effort and interviewed decision makers from the energy, environmental, and HSE areas in industrial companies. While Cagno et al. [2] provide an important contribution related to the varying perspectives that different decision makers may have on industrial sustainability, this case study took this one step further and considered (energy efficiency) investments within the general investment process, and took a comprehensive approach in terms of the included decision makers. This has provided new insights into the way in which sustainability-related investments are prioritized against other investments, and the need for integrating sustainability-related information, e.g., energy efficiency and adjacent non-energy benefits, into investment activities and procedures. As many of the involved decision makers do not specifically work with these issues, integration in investment decision-making becomes even more relevant for companies in order to create awareness and facilitate for how such aspects can be accounted for in the investment process, as well as to enable adoption of sustainability-related investments. The studied case investment also provided insights on how this

may stimulate proactive behavior and encourage the development of more sustainable solutions and thus contribute to sustainable manufacturing.

Several avenues for future research are provided. The main conclusions from this research reinforce the need for integrating sustainability aspects, such as energy efficiency, into internal processes and decision-making. Hence, this paper adds to the sustainability management control literature favoring the integrative approach, e.g., [22,43,60,85], and calls for future research along this avenue. The ambiguities inherent in the activities and procedures of the investment process and the tensions they may cause call for further studies of the configuration of investment activities and procedures. This should also include integration in activities and procedures concerning planning and goal setting to increase awareness and enable an increased priority for sustainability-related investments. Since these activities and procedures constitute the prerequisites for what companies can do in terms of investments, integration in these control elements could plausibly be significant in influencing investment practices. The ambiguities related to the role of information during the investment process leads to the second avenue for future research. Non-energy benefits expressed in qualitative terms (i.e., in text), those relating to social aspects in particular, were often neglected during the investment process. Hence, research is needed to develop indicators for such social aspects of energy efficiency investments to enable for their inclusion in investment activities and procedures. A third avenue for future research relates to the revision and adaptation of controls, such as activities and procedures. Huikku et al. [33] studied the adaptation of controls as a response to a period of increased financial pressure. In a sustainability context, a relevant application would be research which explores the adaption of controls in response to a change in sustainability strategy. Last, improving industrial energy efficiency plays a crucial part in dealing with climate change mitigation and sustainable development [5,86]. Further research on the role of energy efficiency for sustainable manufacturing is therefore called for. There are also conceptual challenges concerning energy efficiency investments and non-energy benefits, which warrant further studies. Frameworks and methods for measurement should acknowledge that energy efficiency might be an additional benefit, and not the prevailing perspective of benefits *from* energy efficiency.

Finally, the limitations of this study should be addressed. The single case study design implies that further case studies in industrial settings would be beneficial for validating the results and to further develop our understanding for investment decision-making, especially related to sustainable manufacturing. This could include comparative studies of the investment process between different industries, as this case study is limited to the PPI. In addition, this case study focuses on energy efficiency investments. While improving energy efficiency can significantly contribute to industrial sustainability [2] and sustainable manufacturing [1], it would also be useful to broaden the scope and address investment processes for investments associated with other aspects of sustainable development.

This study is also limited to the formal management control elements related to the investment process. Future studies should therefore address aspects related to informal and social controls, such as culture and behavioral aspects [68,87,88], and add the dimension of social control to acknowledge both the organizations' and the involved decision-makers' norms and values, which has been advocated in recent studies on sustainability control systems, to enable more effective sustainability management [89].

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