Desired, Perceived, and Achieved Sustainability: Trade-Offs in Strategic and Operational Packaging Development

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Abstract: The alignment of the strategic and the operational level of packaging development in relation to the integration of sustainability is not addressed extensively in current research. This paper aims to address this, by focusing on the decision-making interrelations of key actors (marketing and packaging development) within multidisciplinary product-packaging development teams. The research is conducted by means of a qualitative approach, consisting of semi-structured interviews with individual packaging development team members, complemented with a newly developed visualization tool. The research builds upon eight cases within brand owners, packaging material suppliers and packaging development consultants. The main findings of the study include the decision-making trade-offs between sustainability considerations and other project indicators, such as costs, time-to-market and technical challenges. These trade-offs are linked to the strategic and operational roles of key actors, and to internal and external factors influencing sustainable development processes. This research's contribution is to address the alignment of the strategic and the operational levels of sustainable packaging development, in relation to (1) decision making and interrelations within multidisciplinary development teams; and (2) the relevance of development-influencing factors. This provides opportunities for further development of sustainable packaging models and tools, in order to align the strategic and operational level of development.

Keywords: operational development; strategic development; sustainable development; marketing; packaging development; development team

1. Introduction

The majority of companies acknowledge the strategic relevance of incorporating sustainability considerations in development processes. Independent of the main driver—internal ambitions or external stakeholder expectations—business organizations, NGOs, and policy makers have been aiming for the implementation of considerations towards more sustainable practices, in various sectors. When considering the fast-moving consumer goods (FMCG) sector, packaging-related sustainability can be identified as a relevant area of improvement for companies [1,2]. Examples of sustainable packaging strategies include Unilever's 'Waste & Packaging' strategy [3], Coca-Cola's 'Sustainable Packaging' efforts [4], and the Wal-Mart Packaging Scorecard [5]. However, these strategic aims do not necessarily lead to sustainability considerations being equally important differentiators on the operational level. Within multidisciplinary teams responsible for the design, development, and marketing of packaging, 'sustainability' is merely one of many aspects under consideration.

The relevance of both the strategic and the operational levels of development for the integration of sustainability considerations has been addressed by previous research, for instance by Boks (2006) [6], Gelhard & Von Delft (2016) [7], Johansson (2002) [8], Simon et al. (2000) [9], and Wagner (2015) [10]. However, the emphasis is often on the activities of the strategic level of development, which results in a limited operationalization of sustainability aims in product development processes [11,12]. On top of that, the alignment between these levels in relation to the integration of sustainability in packaging development has not been addressed extensively in currently published research. This study aims to address this gap by researching the coordination of the operational integration of sustainability considerations into packaging development processes with sustainability aims on the strategic level.

This research's contribution is to address the current alignment of the strategic and the operational levels of sustainable packaging development, by focusing on the operational activities of multidisciplinary product-packaging development teams. By means of a qualitative research approach, it specifically addresses the decision making and interrelations of key actors (marketers and packaging developers), and companies' strategic aims, related to sustainability considerations. The research links factors that potentially influence the integration of sustainability in packaging development processes with dependencies and interrelations between actors ('who'), decisions, actions and trade-offs ('what'), and decision-making criteria ('why') within product-packaging development teams. This results in a set of identified 'enablers' and 'barriers', as a framework for the alignment of the strategic and operational levels of sustainable packaging development.

The following section describes the research's point of departure. Following that, the qualitative research approach is addressed, which is tailored to analyze the defined areas of interest. Next, the paper describes the main findings of the qualitative research within product-packaging development teams, specifically addressing the relevance of sustainability considerations in decision making and actor interrelations. This is followed by a synthesis of the findings, which covers (1) identified trade-offs in sustainable packaging development; (2) key actor interrelations; and (3) factors that influence sustainable packaging development. The paper concludes with a discussion and conclusions of the findings, and suggestions for further research on this subject.

2. Point of Departure

2.1. Levels of Sustainability

The traditional perspective on sustainable development focuses on balancing social, economic, and environmental factors, also known as the triple bottom line [13]. For sustainable packaging development, mainly the pillar of environmental sustainability is a relevant point of focus. Therefore, this research mainly addresses the environmental factors in packaging development processes, on three sustainability levels: desired, perceived and achieved sustainability. This reflects both the strategic and the operational levels of sustainable development, as presented in Figure 1. The strategic level refers to a company's mission, vision, and sustainability strategy. This is typically communicated via policy documents, such as corporate social responsibility (CSR) reports, including short- and long-term goals. Therefore, this research considers the strategic level of development to be representative of a company's desired sustainable development.

The operational level of sustainable development relates to the activities of multidisciplinary development teams. These teams are responsible for the tangible development of concepts and products. During and after completion of a development process, the development team members have a certain perception of the level at which the company's sustainability goals are met. This reflection on the company's desired sustainability represents the perceived sustainability in development. The third level covers the tangible (that is, quantifiable) sustainability of the developed product, as a result of the development process: the achieved sustainability. Similarly, Journeault et al. (2016) [14] describe the contrast between desired and achieved sustainability as the "competitive environmental strategy [which] is composed of . . . the intended and realized strategy".
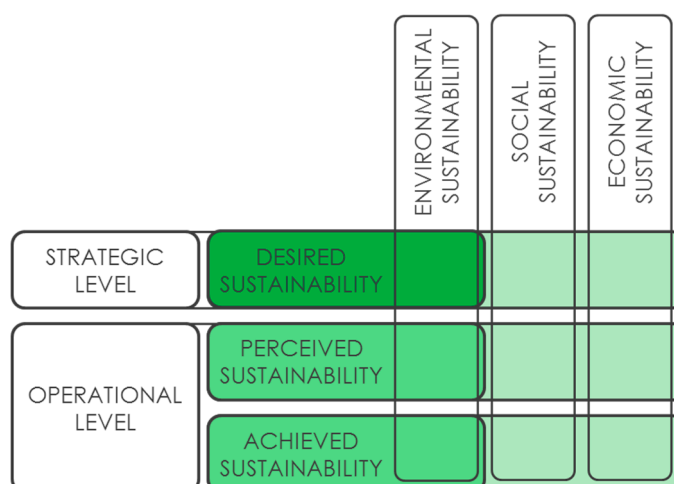
Figure 1. Environmental, social and economic sustainability versus desired, perceived and achieved sustainability.

2.2. Packaging Development

Packaging development can be regarded as a subdomain of 'generic' product development [15], to which the steps of an iterative development process—analysis, synthesis, simulation, and evaluation—are applicable. However, several characteristics of packaging and packaging development distinguish it from other types of product development [16,17].

Packaging serves several functions within a supply chain. The following are generally considered as primary functions (e.g., [17–20]):

- Protecting contained products from external influences and vice versa;
- Enabling product distribution and use;
- Communicating about the contained products.

Within this research, the activities of multidisciplinary packaging development teams are the main subject of study. Such teams comprise various actors, each with specific expertise in development processes. Typical key packaging development actors are marketers, packaging developers, and project managers. However, the exact composition and size of packaging development teams can vary; the tasks and responsibilities of similar actors may differ, or similar actors may be named differently within various projects or companies.

2.3. Sustainable Packaging

The environmental effect of packaging is twofold, with direct and indirect environmental impact [21,22]. The direct impact relates to a redundancy perspective on packaging, in relation to sustainability. This perspective mainly regards packaging according to the environmental impact that becomes apparent in the later stages of a supply chain (after purchase and consumption), by focusing on perceived superfluous packaging and packaging waste. However, this perspective ignores the impact of the product that is contained by the packaging. Packaging is usually intended as a facilitator of a product's ability to provide added value to a supply chain [23,24], aligning with packaging's main functions. This perspective materializes in the consideration of a product-packaging combination—where packaging acts as a beneficial add-on to a product—instead of an isolated entity in a supply chain. Consequently, it is incorrect to consider the environmental impact of packaging separately from the environmental impact of the product contained within the packaging.

A generally applicable definition of sustainable packaging is difficult to identify [25,26]. Well-established are the definitions by the Sustainable Packaging Coalition (SPC) [27] and the

Sustainable Packaging Alliance [28]. Both definitions describe characteristics of sustainable packaging, and focus on the complete life cycle and packaging's functional requirements or performance. However, the consideration of integrated product-packaging combinations in terms of sustainability is limited in both definitions [29].

This research covers both linear and circular sustainability efforts. Linearity is characterized by take–make–dispose systems, in which limited quantities of material return to the system after product manufacturing and use. By definition, linear systems are finite and result in a depletion of raw materials and a surplus of waste. In contrast, circularity aims for the development of products and services for (theoretically) endless material cycles, by balancing inputs and outputs, maintaining technical and economic quality, and eliminating material toxicity [30,31].

2.4. Factors Influencing Sustainability Implementation

The current literature describes various factors that potentially influence the implementation of sustainability considerations in development processes. This section addresses a selection of potentially relevant factors with either a contributing influence (enablers) or an obstructing influence (barriers). Similar dichotomies are described by Boks (2006) [6], Kleinsmann (2006) [32], and Van Hemel & Cramer (2002) [12]. However, descriptions of factors that specifically influence sustainable product-packaging development remain limited.

Table 1 lists a selection of potential enablers and barriers, arranged according to the source of the influence on development processes (internal or external) and the company level at which these are relevant (strategic or operational). All factors are selected from the literature on marketing, product development, sustainable development, and packaging development. Table 1 shows an imbalance between the number of enablers and barriers; in the case of external influences, barriers are completely absent.

This research aims to identify the impact of these factors, by linking the potential influencers to the outcomes of the qualitative research within product-packaging development teams.

Table 1. Factors that potentially influence the implementation of sustainability considerations in packaging development processes.

		Enablers	Barriers
Internal	Strategic	• Management commitment and support [6,8,11,33–36] • Holistic sustainability ambition [8,12,34,37–40] • Marketing-driven sustainability ambition (image improvement; market opportunities) [12,14,39–42] • Profit-driven sustainability ambition [12,14,39,40]	• Lack of management commitment and support [6] • Avoidant sustainability ambition [12,37] • Commercial disadvantage [12,39,41–43] • Attitude towards change [43,44] • Mere focus on incremental product innovation [45,46] • Organizational complexities [6]
	Operationa	• Front-end integration of sustainability considerations [8,11,29,40,47,48] • Integration of environmental milestones in development process [6,8,45] • Application of ecodesign support tools/evaluations [8,11,29,49] • Appointment of multidisciplinary development teams [8,32,35,44,49–53] • Environmental considerations as part of development teams' dialogue [54] • Appointment of sustainability specialist [6,8,11,35] • Early involvement of procurement department [11] • High degree of employee awareness and training [33]	• Conflict with functional requirements [12,45] • Additional workload [6,12,38,40] • Additional costs [43] • Supply chain complexities [6,12] • Lack of suited tools [6,29,35,47] • Lack of cooperation among departments: limited involvement of marketing and sales; gap between environmental proponents and executors [6] • Limited experience [6,40]
External	Strategic	• Market demand for sustainability [12,34,35,40,50] • Governmental regulations [12,39,50]	-
	Operational	• Involvement of external actors [8,12,44,50–53]	• Competitive disadvantage [43] • Customer resistance to design changes [43]

3. Research Approach

The research focuses on the operational activities of multidisciplinary product-packaging development teams. Insights into these development teams' 'ways of working' were collected by means of a qualitative case study approach. This approach is aimed at collecting insights into the explicit actions and perceptions of individual development team members. In addition, insights into implicit aspects of actors' activities are also valuable. For this specific goal, a visualization tool was developed. The features and application of this tool are described in the following sections. Specific details of the development projects' outcome (the tangible product-packaging combinations) are not essential in this study.

3.1. Cases

The qualitative research consists of eight cases, which were selected via a Dutch packaging institute, and the authors' networks and contacts in the packaging industry. In preparation of this research, twenty-four companies were contacted. The number of cases was sufficient to achieve saturation in unique findings: a level of data collection where no fundamentally new insights were provided by the participants. Due to this research's focus on development processes and events, eight cases were suited for an analysis of similar and contradicting patterns [55,56]. The names of the participating companies are anonymized for confidentiality reasons; the cases are listed as Alfa, Bravo, Charlie, Delta, Echo, Foxtrot, Golf, and Hotel. Table 2 provides an overview of the cases' company- and project-related characteristics.

Alfa, Bravo, and Charlie are core cases in this research: for each of these cases, a packaging development project was selected by the project manager, of which multiple development team members participated in the interview sessions. The other cases are peripheral cases, which provide supporting information to the core cases in this research. In all cases, a recent (finished) project was selected, motivated by the 'freshness' of the development process steps, the high chance of participants being able to reconstruct their contributions and decisions, and its representation of a significant level of perceived and/or achieved sustainability results. Delta, Echo, and Foxtrot address a development project of which one actor participated in the research. The interview sessions of Golf and Hotel were not focused on a specific project, but addressed the company's general approach towards the implementation of sustainability in packaging development. Two of the interview participants of Bravo were not involved in the specific project under consideration, but provided peripheral information.

The participating companies were selected on their communicated ambitions—for instance in (publicly available) policy documents and strategic statements, such as CSR documents or dedicated web pages—regarding sustainable packaging, and their role in the packaging development chain. All the involved companies are brand owners in FMCG and non-FMCG sectors, apart from Alfa (a converter/supplier of packaging materials) and Hotel (a packaging development consulting company). Delta and Echo are both part of one company, but focus on different products. Delta develops a non-FMCG product that is marketed and sold as an FMCG product: described as semi-FMCG in Table 2. All companies are located in The Netherlands and can be categorized as 'large' (>250 employees [57]), apart from Hotel (<10 employees). The variance in companies and sectors is complemented with a variance in backgrounds of the participating team members: marketing, packaging development, research and development (R&D), procurement, et cetera. Appendix A provides a list of the interview participants' backgrounds.

Table 2. Company- and project-related case characteristics.

	Case	Participants	Channel	Sustainability Ambition	Sector		Main Driver
				Company	**Project**		
Core cases	**Alfa**	4	B2B	Marketing-/cost-driven	Non-FMCG	Non-food	Market demand
	Bravo	10	B2C	Cost-driven	FMCG	Food	Technology availability
	Charlie	5	B2C	Holistic	FMCG	Food	Company
Peripheral cases	**Delta**	1	B2C	Marketing-driven	Semi-FMCG	Non-food	Company
	Echo	1			Non-FMCG		Company
	Foxtrot	1	B2C	Cost-driven	FMCG	Food	Supply chain demand
	Golf	1	B2C	Holistic	FMCG	Food	-
	Hotel	2	B2B	Marketing-driven	FMCG/non-FMCG	Food/non-food	-

3.2. Interview Sessions

The core of this research consists of semi-structured interviews with individual packaging development team members. For each core case, the respective project manager selected the participants. The interview sessions were conducted with individual participants and took around 90 min each. Insights into the Bravo, Charlie, and Hotel cases were partly collected by means of combined interview sessions, in which two participants were interviewed simultaneously. One researcher conducted each interview, while another researcher took notes of answers and anything noteworthy that emerged. All interviews were audio-recorded for post-interview data processing, with permission from the participants. The interview sessions were conducted between October 2015 and October 2016.

Interview questions addressed the following subjects:

- Current product development approach
- Current packaging development approach
- Division into (development-related) business units
- Actors, actions and considerations in the selected project's development process
- Decision making: criteria, responsibilities and influence
- Desired sustainability: semantics
- Perceived sustainability: semantics and marketing actions
- Achieved sustainability: tangible (quantifiable) results

Appendix B provides the full interview guide. Interview questions considered the actions and perceptions of individual development team members. However, the answers and examples provided by the participants may be on the level of development projects. The interview sessions consisted of three stages:

- Stage 1: Description of participant's main development process contributions;
- Stage 2: Synopsis of development steps ('scenes');
- Stage 3: Networks of interrelations.

The three stages of each interview were guided by a visualization tool, to address the more implicit interrelations between actors, actions, decisions, and criteria, and non-linearity and iterations in development processes, which may be difficult to grasp by means of traditional semi-structured interviews. The core characteristic of the tool is a selection of cards, which cover the various relevant

parts of the interview stages. In the first and second stage, dedicated 'contribution cards' and 'scene cards' were used. In stage 3, the participant was provided with cards to annotate specific actors, information sources, decisions and criteria, and sustainability considerations that played a role in the packaging development project under consideration. In addition, the participant was requested to link all cards by drawing lines and to annotate these, to form a network of all relevant interrelations within the project. The application of the visualization tool provided the researchers with several advantages over traditional semi-structured interviews:

- The interview is substantiated by visualizations of contributions (stage 1), a synopsis of development steps (stage 2), and interrelations (stage 3);
- The participant is actively involved in the interviewing process;
- With the visualization tool, a participant creates a 'talking piece', mainly in stage 3. This creates clarity for both the interviewer and the participant, as the subject of the interview is physically represented. This limits the necessity of creating a 'mental image' and interpretation of the discussed development process by the researchers.
- All sections of the interview will align. Potential inconsistencies in the participant's answers (for instance regarding decisions or actors' involvement) will be visible, providing an opportunity for the participant to adjust this.

Appendix C provides a detailed description of the stages and elements of the visualization tool.

4. Findings

The collected data consists of audio recordings, interview notes, and photos of the final arrangement of the visualization tool. In separate post-interview content analysis sessions, the researchers sorted and structured the collected data per interview and—for the core cases—per project. The main recurring themes and concepts in the interview data led to a set of four project characteristics: 'development processes', 'development team dynamics', 'decision making', and 'documentation', which had an influence on the sustainable development efforts in the various projects under consideration. This set of project characteristics acts as a framework of analysis for the alignment of the strategic and operational levels of sustainable packaging development.

4.1. Development Processes

4.1.1. Stage-Gate Processes

Within the collection of analyzed projects, one can identify a variation in development process management methodologies. Even though Bravo, Charlie, Delta, Echo, and Golf vary in terms of company size, culture, and structure, the participants all describe product-packaging development by means of a stage-gate process [58], aligning with generic development process steps. Alfa and Foxtrot use less formal development procedures, which nonetheless show similarities with typical stage-gate processes. This complies with comments by the participants of Hotel, who described stage-gate processes and similar formalized approaches as the "default type [of development process management] for 'larger' companies". A balance between progress and planning management versus flexibility in day-to-day development practice characterizes the trade-offs between these strict and less formal procedures in the analyzed cases. The stages following the project initiation are similar for both the formal and less formal development procedures: design brief set-up, management approval, and construction of a development team are often mentioned.

4.1.2. Project Drivers

The selected cases show either an internal or an external driver as the main initiator for the project. External drivers are either a market demand/opportunity or the availability of new technology (for instance proposed by a supplier). Only Delta and Echo described sustainability-related

issues—requirements listed by the company's sustainability department in their "sustainability bible"—as a key driver. This identified limited role of sustainability as a project driver echoes other streams of literature, such as described by Kautto (2006) [59].

The researched projects are described as covering either incremental (an improvement of current solutions) or radical innovations. The projects by Bravo and Charlie are characterized by a pre-determined product launch date. For Bravo, this launch date was shown to be dominant over the product development process. For Charlie, the launch date is related to fixed product introduction moments in retail channels. Neither of these launch dates were determined by the development teams.

4.1.3. Product-Packaging Integration

The analysis of the cases shows the development of products and accompanying structural packaging primarily as separated sequential processes—limiting the achieved sustainability in realized product-packaging combinations [1,16,29]. Only in Charlie's project, the development of the product and the associated packaging was conducted simultaneously. However, since this development process was partly outsourced to multiple suppliers, it was beyond the direct influence of Charlie's development team. Therefore, it is considered as a 'semi-integrated' product-packaging development process.

4.2. Development Team Dynamics

4.2.1. Actors and Disciplines

The participants in the interview sessions came from various backgrounds, mainly packaging development, marketing, R&D, quality assurance, and procurement. In five out of eight cases, the participants explicitly describe marketing as the leading department in the considered development processes. According to Delta and Echo, the project lead role is limited to activities related to the organizational management of the project, instead of actual specific product development activities. Delta, Echo, and Golf participants describe marketing actors as the link between the development processes and retail. This is complemented by Foxtrot with a description of packaging developers as the link between (external) packaging production processes, internal packaging line operations, and marketing, and by Hotel with marketing as the link between the strategic level of development and R&D activities. Mainly the brand owners support the role of internal packaging developers or packaging engineers as the external packaging producer's representing actor. Packaging development is explicitly described as a key actor in five cases. Participants from four cases relate the responsibilities of packaging developers mainly to functional, material-related, and production-related packaging features. Following the identified chain of involvement and influence results in marketing and packaging development as key roles in product-packaging development processes, in line with findings described by Petala et al. (2010) [48].

4.2.2. Development Team Structure

The less formal development procedures applied by Alfa and Foxtrot are echoed by their approach towards involving actors during the development process. While the companies that use a stage-gate process involve their development actors at the stages prescribed by their development approach, Alfa and Foxtrot were shown to involve the various actors whenever their expertise was required in the process.

Two cases describe a variation in the composition of teams that focus on product-packaging development for either the short or long term. Golf addressed a dichotomy between market-driven long-term projects and technology-driven short-term optimizations. In contrast, Charlie identified the activities by their market-driven development teams as short-term "innovation or renovation" projects. Their long-term projects mainly concern line extensions and contracts with suppliers, which is managed by procurement actors.

The strategic level of development is not actively involved in either of the cases under consideration. Management actors are informed about the project progress at certain points in the development process (for instance at every 'gate' in stage-gate processes), either by the project manager or by multiple team members. Even though the participants generally regard development input by management actors as highly influential, the involvement of the strategic level of development in the actual development processes is limited.

Even though the company sizes of most cases are similar, only Bravo's and—to a lesser extent—Charlie's cases indicated a complex structure of responsibilities, with corresponding limited transparency in development team dynamics. Bravo showed various involvement layers and overlaps in the responsibilities of the various actors, which is for instance expressed in a project management role shared between multiple actors during the development process. The high number of development team members (refer to Table 2) underlines this complexity. In Charlie's case, the interrelation of development team actors appeared to be mainly focused on informing, not on integrating. This is expressed by a limited influence on the activities of other actors within the development team. In addition, Charlie's management structure divides disciplines and departments into local (national) and international activities, with a further added complexity in development processes.

4.3. Decision Making

4.3.1. Decisions and Criteria

In this research, the main emphasis is on operational decisions: the development activities of the participating team members. However, since operational (substantive) and organizational (procedural) decisions—related to project management issues—are tightly linked [60–62], this section covers both types of decisions.

The researched cases echo the dichotomy of strict versus less formal decision-making approaches. Decisions by Alfa's and Foxtrot's actors are made on an ad hoc basis, when the project's status requires it ("the decision to scale up testing was based on experience"). In theory, the decision moments and accompanying criteria for the more formalized cases are predefined in 'gates'. However, the findings show that in practice actors may deviate from these formal decision moments. In multiple cases, important decisions were not explicitly formalized or supported by policies or standards, but were heavily influenced by subjectivity and the team members' experience. Examples include project initiation decisions that were made before the formal kick-off meeting, or decisions by two actors, while the formal process prescribes a plenary session. This contrasts the various stage-gate processes, which the participants express in terms that are more rigorous.

The decision criteria vary in the analyzed cases; strategic fit and commercial viability are often mentioned. In Charlie's case, the main criteria were the feasibility of the product idea and the business case, with the latter being most important. For other cases, assembly-related issues, supply chain constraints, and material-related considerations were also important criteria. Golf is the only case where sustainability considerations were actively addressed as criteria for the feasibility of a product-packaging concept.

4.3.2. Actors versus Decision Making

Following the observation of marketing as one of the key roles in development team dynamics, marketing actors are leading in decision-making processes in most cases. In four cases, an innovation board was explicitly mentioned as a critical decision maker. An innovation board is a group of actors, representing a company's main development departments on a strategic level. The innovation boards' decisions in the researched cases mostly covered a project's estimated market potential or a proposed business case. However, since actors in this innovation board are not involved in all operational development steps, marketing actors act as the main intermediary between development team actors and decisions by the innovation board. Delta, Echo, and Foxtrot describe this as an "escalation level":

the innovation board is only involved in decision-making processes when irregularities occur in the project, for instance when the project deviates from the agreed planning or budget. As a result, the strategic level can typically be described as a collection of "high influence, low involvement" actors.

Charlie, Delta, Echo, and Foxtrot addressed that even though packaging development and packaging engineering actors were highly involved and influential on product-packaging development processes, their impact on decision making was limited.

4.3.3. External Influences

The research shows that in a number of cases, the decision-making processes were influenced by external factors. External influences were shown to be less dominant in the cases of Bravo, Delta, Echo, and Foxtrot. For Delta and Echo, this was regarded as (partly) related to the companies' internal actors as the projects' initiators. For Charlie, the main external influencer was the producer of the product, who acts as the project's initiator and supplier of the market-ready product-packaging combination. Charlie's size and development approach result in the supplier being highly influential on the development progress. The researchers interpreted the current project status ('on hold') as a result of this external influence. For Alfa, the main external influences came from the client, a design agency, and a packaging part supplier (the latter two were involved in the development process). Golf describes national and international packaging-related regulations as a critical external influence. This includes efforts to "stay ahead of regulations" and to align the variances in regulations with the development process. Foxtrot's interview participant defined requirements by the intended retail channel as a relevant external factor, mainly related to supply chain efficiency.

4.4. Documentation

4.4.1. Kick-Off Documents

In the researched projects, most participants addressed documentation in regard to the initial phases of the development process ('kick-off documents'). The main examples include design briefs, lists of requirements, and business cases. Marketing is the leading editor of these documents, and typically drafts such documents based on input from other development team actors. In Foxtrot's case, the packaging developer coordinated the drafting of the list of requirements. Even though the role of these kick-off documents was valued by the majority of the interview participants, the applicability may vary, due to a limited standardization of the documents: chapters and information—for instance in a design brief—may vary between projects. This aligns with findings by Bruce (2007) [63], Dewulf et al. (2012) [64], and Petala et al. (2010) [48].

The interview participants described only a limited integration of sustainability considerations in kick-off documents. Delta and Echo addressed certain sustainability requirements, posed by the company's global sustainability department. These requirements mainly considered material contents and minimal percentages of recycled material input. Golf complemented a comparable set of targets by typical kick-off requirements related to the elimination of hazardous packaging materials, and requirements regarding post-use recycling and recovery of packaging materials. This fits with the requirements in the EU directive on packaging and packaging waste (directive 94/62/EC [65]), with which all companies have to comply.

4.4.2. Documentation in Later Development Stages

Even though variants of kick-off documents were applied in the majority of the researched cases, standardized documentation in the later stages of the various development processes was limited. In the Alfa and Bravo cases, procedures and routines regarding project documentation were very limited—for example, one of Bravo's participants stated that "the requirement for the concept's recyclability was determined, but not documented". Alfa's participants describes documentation in a variety of formats, such as PowerPoint presentations (for sales actors and clients), Word documents

(e.g., meeting minutes), and e-mails. Similar findings came from the Charlie and Golf interview participants, who described the sharing of various documents (in different formats) via shared storage drives. In Bravo's case, a significant amount of documentation is drafted and collected in retrospect of the development process. Examples include supplier agreements, standards, and procedures. This contrasts Bravo's formalized stage-gate development approach. The lack of a 'paper trail' of the development process can lead to limited iteration options in follow-up projects.

The research shows more rigor in the documentation procedures of other cases: interview participants from Delta and Echo described the formalized documentation procedures as complex and burdening, but it does provide a certain level of clarity and consistency. In Charlie's project, the contents and division of the required development documentation were shown to be flexible, even though documentation is linked to the formalized development process.

4.4.3. External Contracts

For Bravo, Charlie, and Foxtrot, documentation acts as an important tool in their agreements with suppliers. All three companies combine a design brief and requirements into a procurement request or agreement, which is sent to suppliers. Such an agreement includes a concept description, financial and planning-related agreements, and issues regarding material contents for products and packaging.

For Charlie, the highly influential position of the product-packaging supplier results in this procurement agreement being an important document, which is managed by procurement and quality assurance actors. In Bravo's case, adjustments and detailing of the concept under development is not reflected in updates to the specification document that is sent to suppliers.

4.5. Sustainable Development

4.5.1. Strategic Sustainability

All companies have clear ambitions with regard to sustainable development, both regarding products and packaging (desired sustainability), according to the companies' publicly available communications—such as CSR documents—and the interview responses. However, their defined sustainability-related ambitions are more ambiguous. These ambitions are cost-driven (Bravo and Foxtrot), marketing-driven—mainly focused on easy-to-market packaging sustainability results (Alfa, Delta, Echo, and Hotel)—or holistically embedded in the company's identity (Charlie and Golf). Golf even claims that strategic sustainability aims are currently "not listed as part of our company's mission and vision, . . . it's a commodity, it is obvious nowadays". Cost-driven and marketing-driven sustainability ambitions are mainly directed by stakeholders' power, which can be related to improving companies' competitiveness [66]. Organizations with a sustainability ambition beyond or independent of stakeholder pressure are considered to represent a holistic ambition.

Strategic packaging sustainability goals and targets include "sustainable packaging solutions", "circular economy" and (general) "sustainable development", according to various definitions. In three cases, these ambitions are materialized via a dedicated global sustainability department, which drafts sustainability-related policies and guidelines.

4.5.2. Operational Sustainability

For the majority of the researched projects, sustainability is not acknowledged as a direct impact on operational packaging development, including development for packaging communication (on use, contents, and other properties). Research on consumers' willingness to buy [67], attitudes towards brands [68], and the perception of sustainable packaging features [69] shows that the (perceived) sustainability of packaging is highly influential at the point-of-purchase. For operational packaging development teams, the consumer perception towards sustainable packaging could be a valuable project consideration, even though these insights might be difficult to collect; according to Golf: "consumers often don't know all ins and outs".

Only for Delta and Echo, sustainability requirements were a leading project driver. Actors in these projects managed to comply with sustainability requirements by balancing costs, packaging features, and required percentages of recycled material contents. The other cases were characterized by a limited tangible implementation of sustainability considerations. In a few cases, process and supply chain optimizations were mentioned as a relevant strategy for sustainable packaging development. Examples include energy efficiency specifications of packaging production and filling lines, and pallet configuration efficiency. On top of that, the majority of participants respond by repeating the company's desired sustainability, or by indicating realized efficiency claims (achieved sustainability). Actors' perceived sustainability as a consideration during development processes is rarely mentioned.

Alfa mainly focused the project on meeting client requirements and technical feasibility. Some packaging details can be regarded as sustainable development, such as the application of an alternative material and pallet configuration efficiency. However, this was never guided by sustainability demands during the development process. The overall attitude of Alfa's interview participants is heavily focused on the notion that the packaging's base material is inherently sustainable, without further substantiation of this claim. In Foxtrot's case, sustainability considerations were shown to be only relevant when it was a 'safe option', for instance when choosing between alternative materials with known properties and features. For the researched project, the participant indicated that the current, recycled material is a "nice addition", but that it may have been omitted in favor of a virgin material type.

A streamlined quantification of a concept's sustainability score in relation to predefined thresholds is part of Bravo's stage-gate development process. This information is only applied as a post-development check, without a link to front-end development process steps. This results in a limited influence of this sustainability check in development gates. Delta, Echo, and Golf described quantitative sustainability evaluations of the concepts under development as something that is only barely applied, due to the required financial and time investment. Similar findings are described by Kautto (2006) [59].

4.5.3. Sustainability Actors

Boks (2006) [6], Hallstedt et al. (2013) [11], Johansson (2002) [8], and Park (2015) [35] describe the appointment of a sustainability specialist as an enabler of sustainability integrations in development processes. This was further complemented by the interview participants of Hotel: "a sustainability specialist on a strategic position is important". In the cases of Bravo and Charlie, this role is fulfilled by actors with a background in packaging development and engineering. These actors act as a 'sustainability guardian' in the researched projects; they take the sole responsibility for integrating sustainability considerations in the development processes. Within the development team of Alfa, one actor has a similar—but less explicit—role; this actor has a background in marketing. Other actors in the development teams have limited knowledge of sustainability considerations and show less interest in implementing sustainability in the development processes.

The interview participants from Delta and Echo described marketing actors as "indifferent to sustainability considerations". They relate this to the lack of sustainability-related topics as a part of the marketers' targets. In the case of Golf, the responsibility for integrating sustainability in a packaging development projects lies with the packaging developing actors. According to this participant, the activities of marketers are regarded as a "bottle neck" for sustainability integration in development, related to the perceived conflict between commercial targets and sustainable development efforts.

4.6. Overview

Table 3 provides an overview of the key findings. It is important to notice the role of Hotel (a packaging development consulting company) as a peripheral case, which leads to a limited number of case-specific findings addressed in this table.

Table 3. Overview of key findings per case.

	Case	Development Process	Development Team Dynamics	Decision Making	Documentation	Sustainable Development
Core cases	Alfa	• Non-formal process • Separate product-packaging development	• Marketing as key actor • Ad hoc involvement of actors	• Ad hoc decision making	• Limited procedures on documentation • Documentation in various formats	• Limited integration of sustainability • Packaging material is considered as inherently sustainable • Sustainability guardian
	Bravo	• Stage-gate process • Predetermined project launch • Separate product-packaging development	• Packaging development as key actor • Complex structure of responsibilities	• (Theoretic) formalized decision making • Limited external influences	• Limited procedures on documentation • Documentation in retrospect	• Limited integration of sustainability, not part of decision-making process • Streamlined quantification of sustainability as post-development check • Sustainability guardian
	Charlie	• Stage-gate process • Predetermined project launch • Semi-integrated product-packaging development	• Marketing and packaging development as key actors • Short-term innovation projects vs. long-term line extensions • Complex structure of responsibilities	• (Theoretic) formalized decision making • Feasibility of product idea and business case as main criteria • Innovation board as decision maker • Packaging development: limited impact on decision making	• Documentation in various formats	• Limited integration of sustainability, not part of decision-making process • Sustainability guardian
Peripheral cases	Delta	• Stage-gate process • Sustainability as key driver • Separate product-packaging development	• Marketing as key actor and link between development process and retail • Packaging development as key actor	• (Theoretical) formalized decision making • Innovation board as decision maker • Packaging development: limited impact on decision making • Limited external influences	• Sustainability requirements in kick-off documents • Formalized documentation procedures	• Sustainability requirements as leading project driver • Limited application of sustainability quantification • Marketing is indifferent to sustainability
	Echo	• Stage-gate process • Sustainability as key driver • Separate product-packaging development	• Marketing as key actor and link between development process and retail • Packaging development as key actor	• (Theoretic) formalized decision making • Innovation board as decision maker • Packaging development: limited impact on decision making • Limited external influences	• Sustainability requirements in kick-off documents • Formalized documentation procedures	• Sustainability requirements as leading project driver • Limited application of sustainability quantification • Marketing is indifferent to sustainability

Table 3. *Cont.*

Case		Development Process	Development Team Dynamics	Decision Making	Documentation	Sustainable Development
Peripheral cases	**Foxtrot**	▪ Non-formal process ▪ Separate product-packaging development	▪ Packaging developers as key actor and link between production, line operations, and marketing ▪ Ad hoc involvement of actors	▪ Ad hoc decision making ▪ Innovation board as decision maker ▪ Packaging development: limited impact on decision making ▪ Limited external influences	▪ Packaging developer drafts list of requirements	▪ Limited integration of sustainability ▪ Sustainability is only relevant as 'safe option'
	Golf	▪ Stage-gate process ▪ Separate product-packaging development	▪ Marketing as link between development process and retail ▪ Packaging development as key actor ▪ Long-term projects vs. short-term optimizations	▪ Sustainability as criterion	▪ Sustainability requirements in kick-off documents ▪ Documentation in various formats	▪ Limited application of sustainability quantification ▪ Marketing is a "bottle neck" for sustainability
	Hotel	-	▪ Marketing as link between strategic level and R&D	-	-	▪ Importance of sustainability specialist on strategic position

5. Synthesis

The findings resulting from the analysis of the interview data can be related to the alignment of the strategic and operational levels of sustainability in packaging development and the framework of desired, perceived, and achieved sustainability efforts (Figure 1) in the researched cases. The main actor interrelations and decision making by key actors act as the outline for this research.

5.1. Strategic and Operational Sustainability

Even though the researched cases cover a wide variety of companies and product-packaging types, the findings show many similarities between the cases, both on the strategic and the operational level. All participating companies clearly promote their desired sustainability in product and packaging development through CSR documents and online communications.

For a successful integration of sustainability into development processes (from desired to achieved sustainability), management commitment is essential, according to for instance Hallstedt et al. (2013) [11], Jansson et al. (2017) [34], and Johansson (2002) [8]. However, structures and procedures to systematically align management's desired sustainability with operational development processes are lacking in the researched cases. This is indicated by the typical description of the strategic level as "high influence, low involvement" in development processes. As a result, the alignment of the strategic and operational levels of development remains limited. In isolation, either the strategic or the operational level results in a limited influence on environmental performance [70].

A facilitator perspective on packaging development lacks in practice, even though many participants explicitly claimed an integrated view of product and packaging to be relevant for their operational activities. The researched companies showed several circularity ambitions, such as the aim of "working towards a circular economy". However, this was shown to be implemented on an operational level by improving efficiency in linear packaging end-of-life fates (such as reducing post-consumer waste). This was described as "low-hanging fruit" by the Hotel interview participants, which aligns with the description of a "cherry picker" by McDonald and Oates (2006) [71], or what Alakeson and Sherwin (2004) [72], Lucas (2010) [73], and Petala et al. (2010) [48] describe as an "ad hoc approach" Disruptive or innovative sustainable development efforts are not identified in this research. This also holds for companies that claim sustainability to be holistically embedded in their identity and branding.

The application of design briefs and similar documents is a relevant tool for generative development stages [63,64,74]. However, in the analyzed cases, the implementation of sustainability was limited in such documents. Even though (kick-off) documentation showed great variation in format and contents, the role of front-end sustainability considerations was restricted to aligning with regulations and policies. This also closely relates to the lack of sustainability gates or milestones as part of the (formalized) development processes. On top of that, the current level of achieved sustainability throughout the analyzed cases was limited, similar to findings by e.g., Kautto (2006) [59]. Complete product-packaging environmental assessments are rarely used, and are often described as too expensive or time-consuming. If a packaging evaluation is performed, the integration of the findings as part of the development process is lacking, it is merely used as a post-development check.

5.2. Sustainable Packaging Development Trade-Offs

The companies' strategies mainly focus on complying with rules, regulations, and standards. Strategic aims regarding sustainable packaging focus on quantifiable and easy-to-implement opportunities with limited commercial risks. Even when sustainability is a main project driver, the analysis shows trade-offs between sustainability considerations and other product characteristics. Substantive trade-offs—addressing the contents of the development process [60]—are a fundamental element in development processes [25,62,75]. However, this research shows that sustainability is not an equally important substantive trade-off in development processes; it is currently merely regarded as an

add-on to existing product-packaging development aspects, with a limited impact on decision-making processes.

In the analyzed cases, sustainability considerations are never the leading requirement. A product's commercial viability (strategic fit, business case feasibility, and a limitation of commercial risks) and development aspects (timing issues, material use, and supply chain efficiency) are prioritized over desired sustainability goals, aligning with the description of a sustainability cost-effectiveness strategy by Kaskinen et al. (2013) [76].

5.3. Key Actor Interrelations

This research identifies marketers and packaging developers as key actors in product-packaging development processes. Figure 2 therefore explicitly shows these roles in the interrelation between development team actors, and the strategic and the operational levels of sustainable packaging development. In most of the analyzed cases, marketers' roles extend beyond what is traditionally regarded as their core responsibility. Responsibilities for marketing actors were shown to also include organizational management (project management), and engineering governance in development. This results in an unbalanced distribution of power: marketers have a high influence on the product-packaging development processes, over packaging development and other development team actors —such as procurement, R&D, and quality assurance. Besides the lead role in development processes, marketing acts as the leading intermediary between innovation boards and development teams. Therefore, marketing is visualized as the pivotal actor between the strategic and the operational level of development in Figure 2.
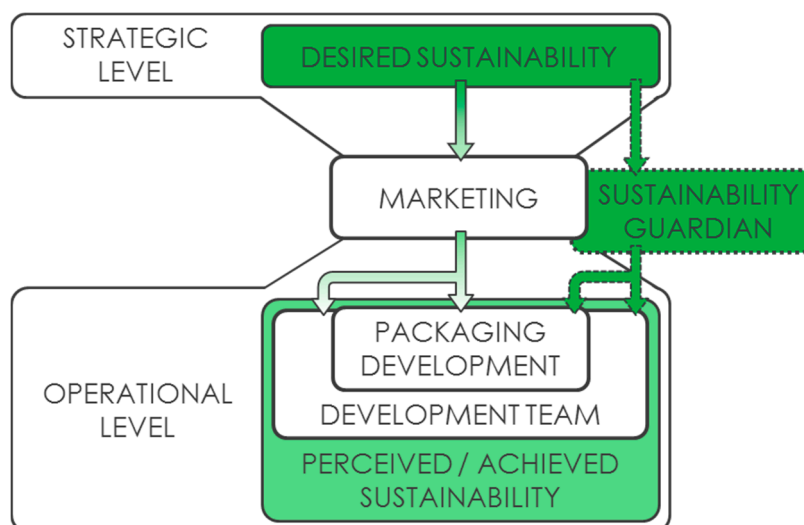

Figure 2. Identified interrelations of key actors in sustainable packaging development.

Development efforts by marketers and packaging developers are mainly focused on direct commercial issues: the market potential and business case feasibility of a product-packaging combination. The research shows a lack of sustainability considerations as a part of operational targets. This results in a weak link between desired sustainability, marketing, packaging development, and the rest of the development team (and thus perceived and achieved sustainability), visualized in Figure 2 by arrows with a green-to-white gradient.

Sustainability guardians are identified in the three core cases of this research. This role varies among the analyzed projects and companies. The most relevant position for such a role is as an intermediate between the strategic and operational levels of development. In this position, a sustainability guardian has the (sole) responsibility for the alignment of a company's desired

sustainability and the activities in product-packaging development teams: the sustainability aspect identified as part of a marketers' current role. As a task in addition to the currently identified tasks of development team key actors (with accompanying responsibilities), this role must result in a more firmly established incorporation of sustainability aspects in product-packaging development processes. Because of the currently identified variance and limited application of this role, it is represented by a dashed box and dashed green arrows in Figure 2.

The figure shows merely top-down interrelations. In the analyzed cases, bottom-up interrelations regarding sustainable packaging development—from the operational level to the strategic level—were not identified.

5.4. Factors Influencing Sustainability Implementation (Expanded)

The research shows relevant enablers and barriers for the integration of sustainability considerations in packaging development processes. This provides an opportunity to review and expand the set of factors described in Table 1, which results in the overview of enablers and barriers for the integration of sustainability in packaging development processes in Table 4. Literature references of factors already listed in Table 1 are omitted.

Table 4. Factors that influence the implementation of sustainability considerations in packaging development processes (expanded overview). Newly added or adjusted factors from Table 1 are indicated in italics; strong factors (i.e., factors that are most clearly identified in the analyzed cases) are indicated in bold.

		Enablers	Barriers
Internal	Strategic	• *Tangible management commitment and support* • *Appointment of a 'sustainability guardian'* • Holistic sustainability ambition • Marketing-driven sustainability ambition (image improvement; market opportunities) • Profit-driven sustainability ambition	• **Lack of *tangible* management commitment and support** • Avoidant sustainability ambition • Commercial disadvantage • Mere focus on incremental product innovation • Attitude towards change • Organizational complexities
	Operational	• **Front-end integration of sustainability considerations** • **Integration of environmental milestones in development process** • **Application of *generative* sustainable development tools** • Application of ecodesign support tools/evaluations • **Appointment of multidisciplinary development teams** • Environmental considerations as part of development teams' dialogue • **Appointment of sustainability specialist/*'guardian'*** • Early involvement of procurement department • High degree of employee awareness and training	• **Conflict with functional requirements *and commercial targets*** • *Lack of sustainability targets for (key) actors* • *Separated product-packaging development* • *Missing iteration loop between environmental evaluations and development process* • Additional workload • Additional costs • Supply chain complexities • **Lack of *generative* sustainable development tools** • Lack of cooperation among departments: **limited involvement of marketing** and sales; gap between environmental proponents and executors • Limited experience; *lack of knowledge*
External	Strategic	• Market demand for sustainability • Governmental regulations	• *Lack of market demand for sustainability* • *Misalignment of regulation types and levels*
	Operational	• Involvement of external actors	• Competitive disadvantage • Customer resistance to design changes

5.4.1. Actors

The role of a sustainability guardian is relevant in sustainable packaging development processes, complementing the key actor roles (marketing and packaging development). In addition to the description of such a role by for instance Boks (2006) [6], Johansson (2002) [8], and McAloone (1997) [77], this role requires involvement on both the strategic and the operational level of development. It adds the responsibility of aligning these levels in relation to sustainability considerations—the practical and

visual application of strategic intent [70]. For a sustainability guardian, bridging the 'language' gaps between development actors—for instance (other) sustainability experts and design engineers [78]—is an important competence.

A potential disadvantage of appointing a sustainability guardian is the limited responsibility or knowledge of sustainability efforts by other actors in a development team. For sustainable packaging development processes, a sustainability guardian requires contextual and specific knowledge of packaging and sustainability. Therefore, a 'distant' sustainability department as identified in a number of the researched cases does not fit this role description.

In the analyzed cases, the limited integration of sustainability targets for key actors was shown to be a barrier. This mainly relates to the low interest in sustainability considerations, in relation to commercial and functional requirements. In addition, besides the integration of key actors in development processes, a multidisciplinary team is a relevant enabler for sustainable packaging development.

5.4.2. Management Commitment

In addition to the commitment of management as an enabler, this research also shows the lack of management commitment as a barrier for sustainable packaging development. This closely relates to the role of a strategic sustainability guardian. This addresses not merely management as an enabler, but requires tangible desired sustainability goals: rules, procedures, and strategies that are operationally applicable. Management commitment also requires sustainable development to be regarded as a holistic issue, not as an add-on to existing development processes.

5.4.3. Development Process

This research identifies several potential development process additions, in order to structurally integrate sustainability in packaging development. A major enabler is the front-end integration of sustainability considerations. This involves the integration of sustainability considerations in kick-off documents (such as design briefs), and generative development tools. This integration must not conflict with functional requirements and commercial targets. It follows that in order to secure the integration of sustainability considerations, the development process requires sustainability milestones, for instance as part of gate decisions. To facilitate iterations, the development process requires a feedback loop of post-development environmental evaluations (such as life cycle assessment (LCA)) into generative development steps [29].

For packaging-specific sustainable development, the integrated development of product and packaging is a relevant factor. This research shows that separated product-packaging development acts as a barrier for sustainable packaging development, related to the main packaging functions and the facilitator perspective on packaging.

5.4.4. External Factors

Table 1 describes "governmental regulations" as a relevant enabler of sustainable packaging development. However, this research shows that the misalignment of regulations can also act as a barrier. Examples include the possible contradictions in national versus international regulations.

Similarly, "market demand" is addressed as an enabler in Table 1. In addition, the lack of a market demand for sustainable packaging can act as a barrier. This closely relates to marketing-driven sustainability ambitions and the front-end integration of sustainability considerations in product-packaging development processes.

6. Discussion and Conclusions

The research findings and synthesis focus on the alignment of the strategic and operational levels of sustainable packaging development, in the selected cases. They show decision making and actor interrelations within multidisciplinary packaging development teams, mainly addressing key actor

roles. In addition, the research shows the relevance of influencing factors (enablers and barriers), and trade-offs regarding the integration of sustainability in packaging development processes. In this research, key actor roles, actor interrelations and decision making, and relevant enablers and barriers were identified for the packaging development field. The potential fit to other fields of (product) development was not specifically researched.

The companies that participated in this research were selected for their ambitions in relation to sustainable packaging. Nevertheless, in general both the strategic and the operational implementation of sustainability considerations in packaging development were shown to be limited. The researchers address 'sustainability' as a broad term, not specifying beforehand the definitions of environmental, social, and economic terms to the interview participants. However, the cases show the environmental pillar to clearly be the most prevailing.

This research distinguished desired, perceived, and achieved sustainability efforts in the analyzed cases, with a focus on the operational activities of multidisciplinary product-packaging development teams. This resulted in 'perceived sustainability' being the dominant section of the collected data. Desired sustainability was collected through CSR documents and online communications, complemented with participants' description of the company strategy. The achieved level of sustainability was assessed by participants' descriptions of environmental analyses and evaluations of realized product-packaging concepts. All companies in this study have clear ambitions with regard to sustainable development (desired sustainability). However, the research findings show that, on an operational level, companies prioritize a product's market potential and a limitation of commercial risks over sustainability considerations. In the majority of cases, sustainability is considered an add-on to existing development processes and ambitions are merely fixed on the strategic level. As a result, perceived and achieved sustainability in packaging development remains limited. This limited alignment between the strategic and operational levels shows similarities with the consumer-focused value–action gap [79] and attitude–behavior gap [80,81]. The steps between recognizing sustainability-related issues in development and acting upon this [82] were shown to be lacking in the analyzed cases.

The identification of sustainability trade-offs in development processes has been previously addressed, for example by Byggeth & Hochschorner (2006) [75], Deutz et al. (2013) [83], and Wever & Vogtländer (2014) [84]. In addition, this research addresses the specific focus on packaging development processes and the interrelations of key actors. The research shows that marketers and packaging developers are key actors regarding sustainable packaging development. In addition to these roles, a sustainability guardian—integrating both the strategic and the operational levels—is indicated as a critical actor. This role is identified in the three core cases. Currently, the alignment of the strategic and operational levels via the key actors is weak; the role of a sustainability guardian is valuable in this alignment, in relation to sustainability in development processes. In addition to the role of a sustainability guardian as a relevant enabler on both the strategic and the operational level, the analysis shows tangible management commitment and support, the front-end (generative) integration of sustainability considerations, and environmental milestones as enablers for sustainable development. Critical barriers include conflicts between sustainability considerations and commercial and functional requirements, a lack of iteration loops, and a limited integration of marketing (as a pivotal actor) in sustainable development processes.

6.1. Research Approach

The research approach was directed towards identifying main factors, motivations, and influences on the decision-making processes in recent packaging development cases. The applied semi-structured interview approach and newly developed visualization tool show great flexibility in addressing the varying projects and interview participants' backgrounds. By using the visualization tool, the researchers and the interview participant(s) jointly developed a physical 'talking piece' of the project under consideration. The interview sessions and visualizations provide insights into the structures

and interrelations of actors, actions, information sources, decision-making criteria, and sustainability considerations within product-packaging development projects. In this research, the application of the visualization tool provides several advantages over traditional qualitative interview sessions.

6.2. Limitations of the Study

One of the main limitations of this study is the limited direct integration of external actors and stakeholders in this research, even though this is addressed as an enabler in Table 1. Retailers, for instance, are a relevant group of external stakeholders. Their strategies and aims in relation to (packaging) development are a potential influential factor on packaging development processes, which is not explicitly included in this research. Similarly, the integration of packaging production is not directly addressed, only via packaging developers as the intermediary between (external) packaging production processes and development teams.

The companies' strategic level of sustainability in the analyzed projects is measured by means of publicly available communication and documentation, and the participants' interpretation of the strategic aims. However, strategic (management) actors were not actively involved in the qualitative study. Therefore, the researchers have not explicitly focused on the drivers behind the companies' desired sustainability. As a result, the implications of the differences between marketing-driven, cost-driven, or holistically sustainable projects are not addressed.

7. Outlook

This research provides opportunities to bridge the gap between the strategic and operational levels of packaging development, specifically in relation to sustainability. In order to bridge this gap, the main findings of this study can be incorporated into packaging development processes by means of development models and tools. An "overall generic tool" capturing the multidimensionality of sustainability may be difficult to develop [49]. Nevertheless, incorporating the identified critical enablers and barriers into development process models and tools is a prerequisite for the alignment of the operational level (perceived and achieved sustainability) with a company's strategic level (desired sustainability) of packaging development. This also implies further research into transforming these factors into environmental action [79].

Key in novel models and tools are (1) the options to handle the identified trade-offs between sustainability and other project or product characteristics; (2) balance 'traditional' functional packaging requirements and sustainability considerations (a facilitator perspective); and (3) integrate end-of-life scenarios and circularity aspects (aligning with strategic aims). In addition, the key role of marketers and packaging developers, with the addition of a sustainability guardian—involved on both strategic and operational processes level—is an essential factor for the alignment of both levels of packaging development. These roles must assist in incorporating strategic sustainability aims into development teams' decision-making processes.

In addition to the factors identified in this research, follow-up research can be focused on addressing project and company characteristics as enablers and barriers. Examples include organizational size and structure, project size and complexity, and product type [85,86], and incremental versus radical innovation projects [45,46].

Author Contributions: Bjorn de Koeijer and Jos de Lange designed and performed the described case studies, and analyzed the data. All authors contributed to the process of writing the paper.

Appendix A. Interview Participants' Backgrounds

Table A1. Interview participants' backgrounds; project management roles in core cases are indicated in bold.

	Company	Participant	Background
1		A1	Product development/project management
2	Alfa	**A2**	**Marketing/project management**
3		A3	Technical product development
4		A4	Sales
5		**B1**	**Technical project management**
6		**B2**	**Technical project management**
7		**B3**	**Marketing/commercial project management**
8		B4	Technical product development
9	Bravo	B5	Technical product development/material specialist
10		B6	Rules & procedures/packaging development
11		B7	Rules & procedures
12		B8	Environment & safety
13		B9	New product industrialization
14		B10	New product industrialization
15		**C1**	**Marketing**
16		C2	Research & development
17	Charlie	C3	Packaging development/quality assurance
18		C4	Quality assurance
19		C5	Procurement management
20	Delta	D1	Packaging development
21	Echo	E1	Packaging development
22	Foxtrot	F1	Packaging development
23	Golf	G1	Packaging development
24	Hotel	H1	Packaging development (consulting)
25		H2	Packaging development (consulting)

Appendix B. Interview Guide

Appendix B.1. Introduction

Appendix B.1.1. Introduction Round

- Who are you and who are we?
- Targets

    - For us: collecting insights into packaging development practice
    - For participant: evaluation of own 'way of working' of packaging development

- Confidentiality

    - External: information on company and project is anonymized
    - Internal: information on processes is not shared between participants, unless permitted

- Session planning

    - Introduction (15 min)
    - Interview + visualization tool (60 min)
    - Round-up (15 min)

Appendix B.1.2. Explanation of Visualization Tool

- Most important (personal) contributions in project
- Process description of reaching these contributions ('scenes')
- Map information and communication flows ('networks'), by means of dedicated elements:

  - Actors
  - Information sources
  - Decisions and criteria
  - Sustainability considerations
  - Links and annotations

- Constructing a personal legend of the various card colors, link types, and levels of involvement and influence of the various actors
- Short example of application of visualization tool

Appendix B.1.3. Project Introduction

  - Allow the participant to describe the project

- General project description
- Applied design methodology (product development and packaging development)
- Project management structure (development-related business units)

Appendix B.2. Project Contributions

- Identification of participant's most important project contributions

  - 3–5 contributions are listed on dedicated cards

- Substantiation and explanation of contributions

Appendix B.3. Synopsis of Development Process ('Scenes')

- Which steps were applied to reach the described project contributions?

  - Scene cards are applied to describe a synopsis of the participant's contributions

Appendix B.4. Networks

- Variations in the order of set-up of interrelation networks are applicable

  - Who were involved (both internal and external actors)?
  - What sources of information did you apply?
  - Which decisions were made?
  - What were the critical criteria for these decisions?
  - Who was involved in these decision-making processes?
  - What was their level of involvement and influence?
  - How did you collect and select the relevant information?
  - Desired sustainability: semantics
  - Perceived sustainability: semantics and marketing actions
  - Achieved sustainability: tangible (quantifiable) results

Appendix B.5. Round-Up

- Closing the interview session

- Other issues (either from researchers or participant)
- Agreements

    - Follow-up
    - Confidentiality

- Word of thanks

Appendix C. Visualization Tool

The visualization tool consists of three stages, which focus on different parts of the participant's view and experience of the development process in the project under consideration: a recent radical or incremental packaging (de)development project:

1. Contributions

The first stage aims at refreshing the participant's memory on the contents of the project and provides the researcher with a basic understanding of the participant's role in that project. The interviewer asks the participant to list the main (two to five) contributions in the selected project. These contributions are determined by the participant, according to the significance of their own activities within the project. These contributions must be written down on dedicated 'contribution cards', as a concise description of the action.

2. Scenes

The second stage of the tool addresses a synopsis of the development process as a chronological order of steps, or 'scenes'. Depending on the participant's role in the project, these scenes can be one successive set of development steps and actions, or multiple parallel sets. The aim of this stage is to cover the whole range of development process steps in which the participant was involved. The participant writes down the scenes of the development process on 'scene cards', see Figure A1.

3. Networks

The final stage of the visualization tool aims at developing a network of actors, decisions, criteria, and information sources. This network covers the actions and development process steps as specified by the participant in stages 1 and 2. This stage covers the participant's roles in the project, and all relevant connections to the participant's project contributions. The participant is provided with an array of cards, with various degrees of freedom:

- *Actors*: actor cards can represent an individual or a group of actors. The actor cards are provided in various colors, of which the participant is free to determine the meaning. Finally, the participant can indicate their perception of the various actors' levels of involvement and influence on the development process.
- *Information sources*: all relevant types of information and documentation—such as design briefs, market research results, or meeting minutes—can be visualized by dedicated 'source cards'. As with the actor cards, the participant is provided with various colors for these cards.
- *Decisions and criteria*: all relevant decisions can be identified with dedicated 'decision cards'. These cards provide space to note relevant decisions. Separate 'criteria cards' can be linked to the decision cards, to list the various criteria for decision making, see Figure A1.
- *Sustainability considerations*: the visualization tool incorporates dedicated cards for sustainability-related issues in the development process. This could for instance address a document that describes sustainability goals, a key sustainability-related decision, or a specific actor with a sustainability governance role.
- *Links and annotations*: the participant is requested to link all cards by drawing lines. The lines can be annotated, in order to clarify variations in the meaning of the links between entities.

Figure A1 shows the various elements of the visualization tool, in an example post-interview configuration.
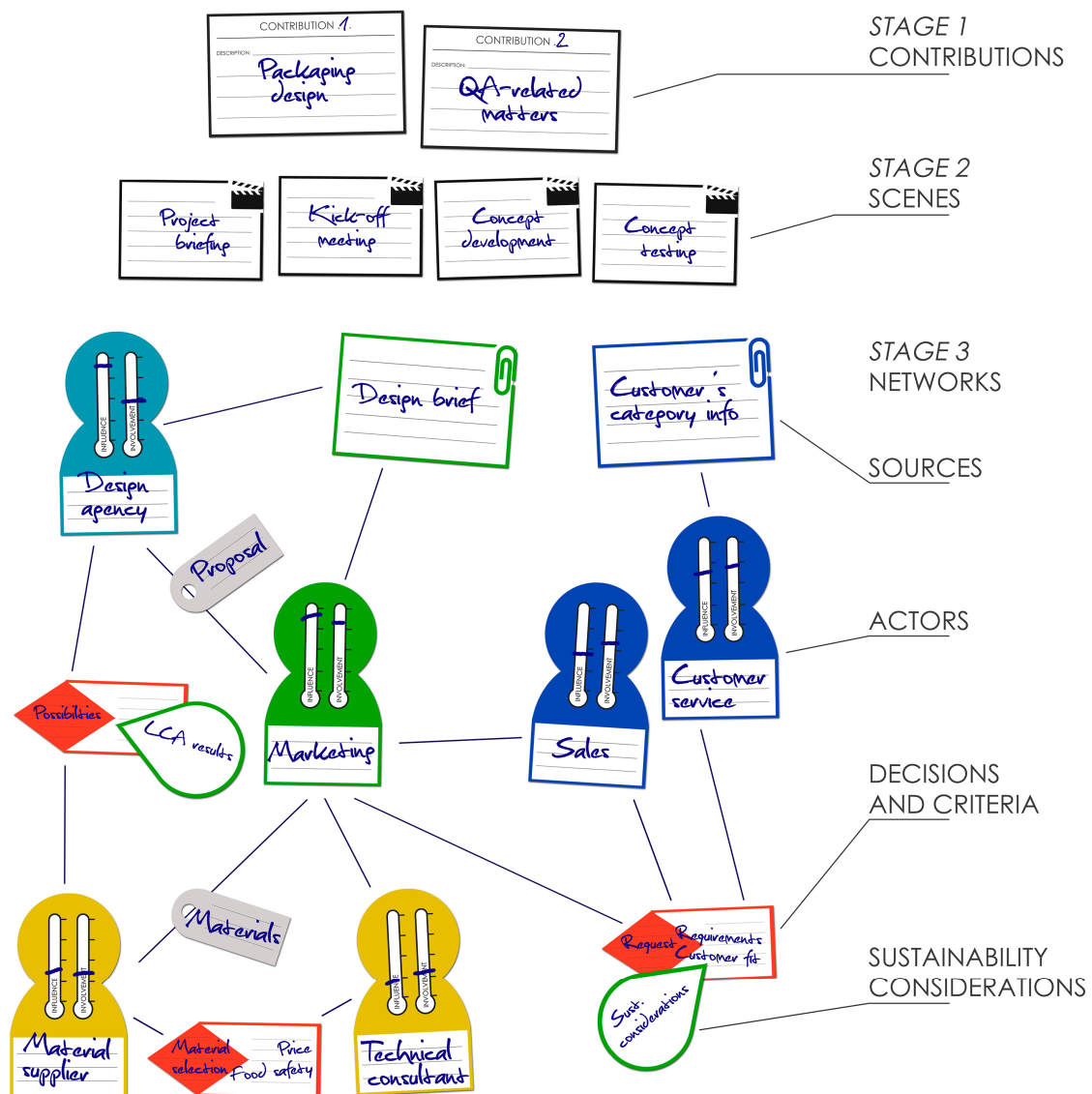

Figure A1. Visualization tool elements (example post-interview configuration).

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