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An explorative design research for the optimization of sustainability for logistic service systems within an e-commerce setting: Using consumers to optimize for sustainability

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The thesis investigates the optimization for sustainability in logistic service systems within the retail e-commerce sector. The need for this research arose, as existing e-commerce companies are looking to explore new opportunities to reach sustainable pledges. In the research, it is determined that by making consumers more conscious about their choices, and steering them in the right direction, a logistic service system can become more sustainable. The estimated reduction of CO2 emission, caused by the created solution, is around ~0,2 - ~0,5 percent of the case company's total emission. Since the case-company is large of size, the reduced CO2 emission is significant. However, small e-commerce companies will not make significant impact with the percentual reduction. Therefore, it can be questioned whether the choice of consumers will still be relevant now, or in the future, as technical innovation reduce the impact of consumer choices in the field of sustainability.

E-commerce, logistic service systems, sustainability

1. Introduction

The demand of consumers for more sustainable e-commerce shopping is ever growing [1]. It has become necessary for brands to not only attract, but also keep consumers while growing a sustainable brand [2]. Growing a green brand, will allow for a higher level of relation building with consumers, and will reduce barriers which companies might otherwise not overcome [3]. A consumer can shop from home, their work, or on the road. The consumers can compare prices and quality, over different platforms, with the blink of an eye. However, the impact the online shopping scene is creating can be harmful both environmentally, and socially. The e-commerce must be made more sustainable, so the positive effects are able to outweigh the negative effects [4-5].

E-commerce companies are looking for ways to improve on their sustainability to improve customer relations and decrease negative effects [6-7] One of the main contributors to the sustainability levels of e-commerce companies are the formulated logistic service systems [8]. This research has been requested by an e-commerce case-company, to help explore opportunities for the optimization of logistic service systems for sustainability within the e-commerce setting. The company had requested that the design research would focus on the context of that company. The requested research has been rewritten into a focused research goal: To discover and design methods by which logistic service systems can be optimized to become more sustainable within the e-commerce sector.

2. Logistic service system context

To discover and design methods by which logistic service systems can be optimized to become more sustainable within the e-commerce sector, the context of the design must be defined. The context must be defined, as there are many different types of retail e-commerce companies, which could need different solutions to solve the same question. In the thesis setting, the logistic service system functions in a national sized company operating in the Netherlands and in Belgium. The company is an online retail e-commerce company marketplaces [9]. The logistic service system's revenue models are based on service subscriptions, and service sales [10]. The logistic fulfilment methods used within the case-company are in-house-, and third-party fulfilment types [11].

3. Logistic service system

To describe the functioning of logistic service systems, a general service system is transformed into an abstracted version of a logistic service system. Within the thesis, a logistic service system is defined as consisting of different services, actions, logistic roads, and stakeholders. *figure 1*, the abstracted version of a logistic service system is defined.

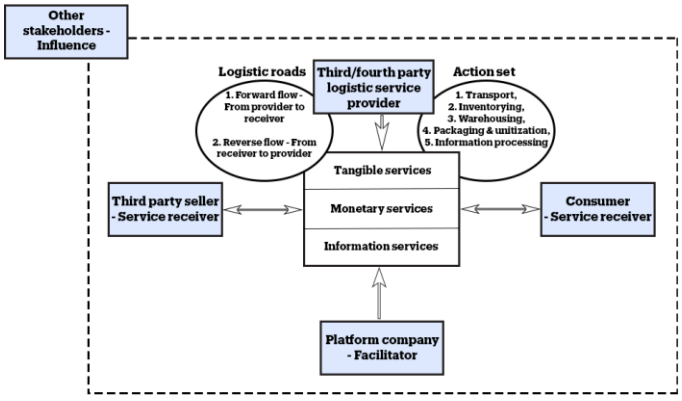

***Figure 1**: Abstract logistic service system*

2.1. Services & actions

Logistics are defined as the organization/management of transport, inventory, warehouse, packaging & unitization, and information processing of product-, cash-, and information flows [12-13]. The logistic service system model will use the mentioned flows, and transform them into the perception of services: tangible-, monetary-, and information services. The services are indicated in *figure 1* in the central block of the service system.

The defined management of transport, inventory, warehousing, packaging, and information processing will be viewed as building blocks, which allow for the execution of each service. Each service, depending on the execution of that service, will require a different set of actions. Due to the differentiation of actions, optimization solutions that fit one company/logistic service system, might not fit a different company/logistic service system. The actions are defined in *figure 1* in the action set bubble.

2.2. Logistic roads

Within logistics, there is made a differentiation between forward logistics and reverse logistics[14]. Forward logistics handle all flows of goods downstream, towards consumers. Reverse logistics is defined as the movement of goods from the consumer in an opposite direction. In the thesis, both flows are included as possibilities to optimize the logistic service system. This is indicated in the logistic roads bubble in *figure 1.*

2.3. stakeholders

Stakeholders will form the input for the design requirements of this design research. The logistic service system model has defined five stakeholder groups, which encompass all stakeholders within the logistic service system: third party sellers, consumers, platform company, third/fourth party logistic service providers, and "other" stakeholders. The first four groups are directly involved in the logistic service system. The "other" group, entails stakeholders as NGOs, government, and the public, and indicates stakeholders who influence the logistic service system through regulations and demands.

The stakeholder groups represent a first level of detail which represent the befitting stakeholders. The research will not search for more detailed stakeholder groups as it will widen the scope too much.

4. Optimization

Optimization is defined as: "The action of finding the best possible outcome amongst many variations and solutions"[15]. Within the logistic service system setting, optimization would imply, finding the best configuration in a service system to fit the needs of the service receivers. General optimization is determined to have four steps: opportunity, quantification, de-situation, and formulation.

The research has defined that there multiple means through which a service system can be optimized: through improving existing elements, and through the addition of new elements to the process.

5. Sustainability

Sustainability is widely acknowledged to consist out of three pillars: social-, financial-, and environmental sustainability [16]. Sustainability is in many researches indicated in a triple-venn diagram. However, this research tries to define sustainability in a different method. The triple-venn diagram does not account for the weight of each of the pillars of sustainability. A different model, the Russian doll model, does cope with the different weights in sustainability [17]. The Russian doll model is displayed in *figure 2.* In the Russian doll model, the environmental pillar is viewed as the most important focus, then society, and then economy. Nevertheless, it is said that without a good economy- and a good society-, a good environmental dimension cannot be achieved [17]

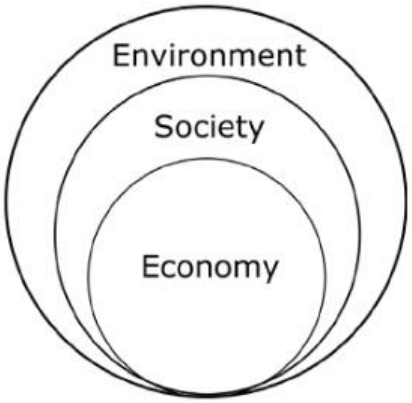

Figure 2: Russian doll model [17]

6. Requirements

The requirements are defined from the needs of different stakeholder groups. The needs from the platform company-, third party seller-, third/fourth party logistic service provider-, and "other" stakeholder groups, have been defined through literature- and web research, and through informal conversations with experts in within the case-company. The consumer needs have been defined through literature and web research, through informal conversations with experts, and through empirical research. The reason for consumers to be thoroughly researched, is that consumers are deemed to be the driving force in logistic service systems. Happy consumers imply happy platform, logistic service providers, and sellers, due to business related aspects.

From the stakeholder analysis, eighteen requirements were established. The requirements were ranked in the MoSCoW system [18], based on the relations between stakeholders, and the power they have over each other. The requirements consisted of seven must-have-, six should have-, three could have-, and three will not have requirements.

The outcome of the stakeholder analysis and the generation of requirements have, from this point on, scoped the research from a general optimization perspective, to "optimization through customer interaction within logistic service systems". Customers had indicated that they do not feel connected or informed about the choices they make within a logistic service system. By doing so, the consumers provided the research with a clear opportunity to improve the logistic service.

7. Ideation

The goal of the ideation phase is to generate concepts to optimize the logistic service system, with the help of consumer interaction. The ideation phase of the research focused on the use of both individual brainstorm methods, and group brainstorm methods to generate the concepts. However, the research was restricted by the amount of experts available within the case-company. Therefore, the research has only made use of individual brainstorm technique: Freewriting. Three freewriting sessions were performed, each lasting 10 minutes. After the freewriting sessions were done, the five best concepts, or combination of concepts, have been portrait in the results of the ideation. The concepts are listed below, with one descriptive sentence on the concept.

Sustainable customer journey: Alter the customer journey so consumers make more sustainable choices.

Family accounts: Let consumers indicate that they live in the same household, so they can share information and bundle shipments.

Crowd shipping: Let consumers collaborate to create a more sustainable logistic service system for each other.

Flash delivery: Let the company employ bike flash delivery so consumers can order products from pick-up points whenever they are at home and ready.

Mother company logistics: Let different sister companies match logistics, so shipments from the companies to the same address, will be performed in one order.

8. Concept potential

The potential was identified through the use of the a model called: "the sweet spot of innovation". This model defines the potential of concepts through three pillars: feasibility, viability, and desirability, *see figure 3* [19]. To define the pillars worth in each concept, semi-structured expert interviews were conducted. The expert interviews were held with twelve experts from within the company, all having different specialisations in subjects like logistics, UX design, sustainability, and customer journey.

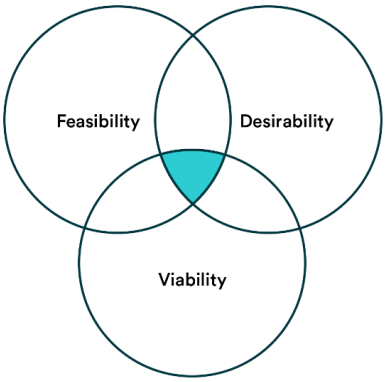

Figure 3: Sweet spot of innovation[19]

After six expert interviews, it was determined that the created concepts have potential. The concept, which was defined to have the highest potential, has found to be a combination of the customer journey, and family concepts. However, all experts did indicate that they did not know how the concepts would fit in the companies customer journey. That is why the remaining six interviews were conducted to identify the fit of each concept within the company's customer journey. The most important finding of the second halve of the expert interviews was: The concept would have to be shaped on a location that did not directly impact the current customer journey. Tips were given on how to do so, but those tips cannot be detailed in this publication.

9. Final concept theory

The concept theory consists of two segments, the theoretical body of the concept, and the theory behind behavior change

9.1. theoretical body of the concept

The theoretical body of the prototype consists of three building blocks that built on top of each other: Inform, activate, and expand. Each of the three blocks has its own function and place within the built.

First, the goal of the inform block is to passively steer consumers towards sustainable choices. The inform block will form the basis of the solution, and will ensure that consumers are informed about logistic service system, choices within that system, and the sustainable impact of those choices. The other building blocks cannot be formulated without the inform block, as consumers will remain uninformed, which is against the earlier established criteria (*section 6) [20]*.

The second block, is the activation block. This block aims to actively steer consumers towards sustainable choices. The activation will consist of interactive features, by which consumers will become more sustainable. How the consumers will be steered towards sustainable behavior, will be discovered in *section 9.2.* Without the activation block, it will be difficult for the expansion block to exist, as consumers would not be used to interaction with the logistic service system [20].

The last block, is the expansion block. Within this block additional features, which are not currently available, will be created, and added to the active interactions. The final prototype will use the sustainable customer journey concept as part of the inform and activation blocks. The family concept will serve as the expansion of the solution.

9.2. Steering consumers towards sustainability

To steer consumers towards sustainability, the SHIFT-framework is used [20]. The SHIFT framework describes barriers which might lead consumers to take unwanted actions. The barriers link to the five different subjects: social influence, habit formation, individual self, feelings and cognitions, and tangibility. The framework identifies that solving the barriers might lead to different, wanted, behavior. Within this research, six barriers have been defined. The barriers are solved within the formulation of the inform and activation blocks in the final prototype.

10. Prototype – MyLogistics

The final prototype has been given the shape of a logistics product page. The page contains the information and activation aspects of the prototype. The expansion of the prototype is placed in a different location on the platform, as the family concept does not only contain logistics aspects. The information contained in the prototype is focused on logistic service systems, sustainability of logistics and the platform, and optimization projects surrounding logistics. The information is spread on the product page, and can be found on individual locations, or combined with activation features, or expansion features.

The activation is given shape in three segments: logistic settings, consumer behaviour feedback, and achievements. The settings aim to allow consumers to change default functions of logistic interactions. Currently, the set defaults focus on ease of use, but some might want more sustainable defaults. This option will allow consumers to do so. - The feedback will allow consumers to gain insight into their behavior. The feedback focusses on the emissions, consumers cause, and compare them with their choices and other consumers. Thereby, consumers are socially held accountable. - The achievements function as incentives. Consumers can earn points to use for discounts or other benefits on the platform. The achievements relate to sustainable activities which consumers can perform to reach each achievement.

The expansion is given shape as the family concept. The family concept allows consumers to group accounts within the family, and link information to each other to enable sustainable behavior. Additionally, consumers can link orders between accounts. By doing so, products can be packed in the same box, reducing packaging, and preventing unnecessary transport.

11. Analysis of prototype potential

The prototype is found to adhere to the most important requirements. Some requirement fits have been theorised, and therefore there is a need to conduct further in depth research on the topics. The prototype potential is further investigated by subjecting it to the "sweet spot of innovation" framework (SWEET SPOT SHIT).

11.1. Feasibility

The feasibility of the concept is theorised based on the outcome of the expert interviews, and the professional judgement of the researcher. The prototypes feasibility was judged on implementability, maintainability, and company fit. The prototype, in current state, is deemed feasible. The prototype was approved on all three aspects of the feasibility. However, a remark was made about the privacy aspects of the prototype. Since the prototype relied on data share between consumer accounts, a privacy issue arose. It is not known by experts whether the privacy implications will form a problem for the feasibility of the prototype. The privacy regulations would require further investigation.

11.2. Viability

The viability is defined through the definition of different improved elements, were the amount of possible change within each element, is crossed with the amount of potential CO2 reduction each change can bring. After the calculations were performed, it was estimated that the prototype could create an impact of ~77.375.000 - ~197.750.000 g CO2 reduced per year. This equals around ~0,2 - ~0,5 percent of the total company emissions.

11.3. Desirability

The desirability of the prototype was defined through an empirical study. Consumers were asked about their opinion on the prototype in a semi-structured interview format. The consumers were shown the prototype, and were given a short introduction about the research and the goal of the prototype. In general, the consumers liked the prototype. None of the consumers indicated to dislike a feature within the prototype, and they all defined to think that they would change their behavior because of it. What was evident, is that consumers all indicated to be affected by different features within the prototype, and no one feature could be deemed "the best".

12. Conclusion

A logistic service system in a retail e-commerce platform company, can be optimized for sustainability through the use of consumer interaction. The use of a product page to create passive and active interaction between the consumers and the logistic service system is capable of reducing the CO2 emissions of a logistic service system.

The feasibility of such a system is theoretically possible. However, to the define the feasibility of the concept completely, further AB tests and expert opinions are required. The concept is deemed viable. The viability of the concept is estimated to achieve around ~77.375.000 - ~197.750.000 g CO2 reduction per year. This is a low bound estimation, and is likely to be a higher number in reality. Consumers desired the concept. They indicated that the concept would expectantly help them behave more sustainable. What was notable, is that different consumers indicated that different features would influence them more, example: some consumers defined the feedback feature to make more impact on them, and some define the settings feature to be more important.

13. Discussion and recommendations

The research suffered mildly from resource constraints within the case-company. Some choices were made hastily due to time constraints, and some activities could not be performed due to personnel limitations. Nonetheless, the research is deemed trustworthy and complete.

Future steps taken in the research are recommended. To improve the prototype design, it is recommended to create more sophisticated visualisations, detail the activation features – and define which hold the most potential, detail the family concept and to research the impact on the customer journey. Further improvements relate to the potential analysis, where a following research could make a realistic prototype and test the prototype and research privacy implications of the prototype to improve the feasibility testing – could perform an LCA to identify emission reduction more precisely and calculate costs to provide better advice to the case-company to improve the viability analysis – could generate more insight through qualitative empirical studies verify the insights from the qualitative studies through the use of quantitative empirical studies to improve the desirability analysis.

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