Sustainability in the front-end of innovation at design agencies
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Abstract
In the two last decades a considerable amount of research has been conducted on the Front End of Innovation. This is the stage of the product development process where the design brief is formulated. This phase is argued to be crucial to the success of the final product. While the Front End of Innovation in general has been a hot research topic, little research has been conducted on its relationship to design for sustainability. Indeed, within Design-for-Sustainability literature a strong focus can be observed on the phase after the formulation of the design brief.

Many companies hire external design agencies for their product innovation. In such collaborations, goals and targets for the design project need to be clarified in the early stages of the project, including sustainability targets. The role of design agencies in design for sustainability is also under-researched. This paper discusses the potential of sustainability as a value-adding activity for design agencies. It explores how design agencies deal with sustainability issues in the Front End of Innovation. The analysis is based on in-depth interviews with five major Dutch design agencies. Findings show that a distinction can be made between incorporation of sustainability as a consequence of a client request (i.e. client-driven sustainability) and when sustainability is incorporated into the project by the agency (i.e. agency-driven sustainability). Also, agencies appear to deal with sustainability on a decomposed level. This study has initiated an array of follow-up studies, which are sketched in the further research section.

Keywords: design bureau, design consultancy, fuzzy front end, goal finding, target setting

1 INTRODUCTION
The so-called front end of innovation (FEI) is a very early phase in the product development process. Simplified, it is the stage where one decides what to make and defines the project conditions, i.e. the stage where the design brief is formulated. This phase is believed to be crucial to the success of the final product. Also, with respect to the effort made, this is claimed to be the phase in the product development process with the highest payback with respect to one’s investments.

While the Front End of Innovation in general has been a hot research topic, little research has been conducted on its relationship to design for sustainability. Indeed, within Design-for-Sustainability literature a strong focus can be observed on the phase after the formulation of the design brief.

As goals and targets are expected to be more explicit in cases where there are multiple parties involved, the context of external design agencies is deemed an interesting focus of studying the relationship between sustainability and the FEI. The FEI consists in this context of the formulation of the design goal and translation of that goal into targets in the design brief (which may be a formal document, but also an oral agreement).

In [1], Hassi et al. illustrate the components of sustainable innovation as shown in Figure 1. The model represents how an organization goes from an organizational commitment towards sustainability (Why are they doing it) through, the organization (Who is going to do it) and goal finding (What exactly will be done) to finally the practical realization of the initiative (How to do it)

Fig. 1: The different stages of sustainable innovation [1]

Further, Hassi [1] argues that research within design for sustainability so far has focused on Why and How, less attention she claims has been given to Who and What. The Why and Who questions form the front end of innovation.
2 FRONTAL ENDO OF INNOVATION

The front end of innovation, is a widely used term by innovation and product development scholars [2-5]. [5] states that it is the "... process, the time and activity prior to an organization's first screen of a new product idea." In the literature there is some disagreement considering how far into the product development process, PDP, the FEI goes. While some see it as a process ending with the design brief, others, among them [2] and [4], also includes the concept development process. In this project the FEI will be used to describe the process leading up to the project definition and the brief.

As the FEI is initiated before there really is any project organization or goal to back it up, it has often been seen as a somewhat unclear and fogged out part of the PDP. Due to this, FEI was often referred to as the fuzzy front end of innovation, FFE. This term is however critiqued for being misleading and "...incorrectly suggests that unknowable and uncontrollable factors dominate the front end, implying that this initial part of the innovation process can never be managed" [3].

As activities and choices made in the FEI will affect all stages of the following development process, the FFI is seen as crucial phase of the PDP. [3], [4] and [5] among others claims that this is the most important stage of the product development process and that this is the phase with the largest impact on the end result of the project. [3] claims there is a strong relationship between a company's skill in FEI and the company's ability to innovate.

It is stipulated here that the FEI, although characterized by unstructuredness, may differ strongly between organizations with formalized innovation processes and those without.

The main research goals for this project are:

- Provide insight and knowledge about design for sustainability in the front end of innovation at design agencies.
- In a larger context provide insight and knowledge about the Sustainable Innovation in the Front End of Innovation, to further develop this field of research. (connected to this work on design agencies, the research group also works on different contexts such as multinationals [6,7]).

The research questions given from the assignment text are:

- How do design agencies incorporate/execute the fuzzy front end in sustainability projects?
- How do design agencies incorporate/execute design for sustainability in fuzzy front end projects?

Both questions combine the topics of fuzzy front end/ front end of innovation and design for sustainability in design agencies.

3 DESIGN AGENCIES

Design agencies/studios are companies that perform design actives for their clients. As design is a broad term, almost all design companies are specialized within one or several sub disciplines. Among the most common one can find, graphical design, web design, fashion design, product design, process design, and interior design and many more. It is beyond the scope of this work to study all of these disciplines; the focus of this thesis is on product design.

Product design agencies are not a homogenous group in itself. It is reasonable to differentiate between “design engineering” agencies and the more “artistic design” studios. Artistic design studios have a strong focus on the esthetic part of their product and the feelings it creates in the user. An engineering design studio usually has a stronger focus on the functions of their products; they are user and technology focused. The focus of this work will be on design engineering agencies. The relationship between design agencies and sustainability has not been widely researched. Notable recent work includes [8].

4 METHODOLOGY

In this study, an exploratory approach was taken. This study intends, in a qualitative way to reveal what design agencies are doing in the FEI and how sustainability affects and is affected by this.

In-depth semi-structured interviews with design agencies were used to provide qualitative information about the research subject. Qualitative data can give insight into what is happening and the reasons for this behavior. However this does not easily generalize and tells little about frequency. A pilot interview was conducted to test the initial interview guide and get experience with the interview situation.

Sampling is of great influence on findings. In this study we chose to focus on mainstream agencies, which can be considered leaders in the field of design consultancy in the Netherlands, but do not necessarily have an established reputation for their sustainability expertise.

In the interviews, an approach was chosen where the interviewees are asked to present a picture of the full width of the practices within their agency, i.e. the focus is not on the most advanced examples, but at creating a picture of the entire overview of daily practice in design agencies.

For this study it was decided to investigate technical field of design development agencies, preferably medium or large agencies with experience from both design for sustainability and the front end of innovation.

Possible design agencies for the study were identified through web search and by recommendation from Delft University of Technology staff. Agencies were first screened quickly, to see whether they fitted with the criteria of technical product design. If this demand was
met, their webpages were examined to investigate the three remaining criteria: size, sustainability and FEI. While not all of these criteria could be positively identified through the search, it at least gave an indication of the company’s profile.

Of the 19 agencies that were analyzed, 12 were contacted and 5 accepted to be part of the study. Of the 7 companies that did not enter the study, 3 companies never answered the request, 4 companies denied the request (2 of which, because they found the research question irrelevant for their company, Sustainability had nothing to do with their FEI and 2 because of other reasons). The five agencies that participated in the final study would generally be considered to be part of the top 15 product design agencies within the Netherlands.

The interviews were conducted at the agencies. With the exception of Agency 5, all of them lasted approximately one hour. At Agency 5 the interview time was reduced to 30 minutes due to high workload on their part. Before each interview an information search of the company was conducted, their webpages were studied in detail and also Google free text search were used to find relevant background information. During the interview the interview guideline and an agency info sheet made from the search results were used as an aid. With the exception of Agency 5 all interviews were recorded with both notes and audio, at Agency 5 the audio recording malfunctioned. Due to both the audio recorder malfunction and the reduced time, the results from Agency 5 are much less comprehensive than the other.

5 ANALYSIS

The interviews were transcribed chronologically by use of key word, sentences and statements. The transcript was further transferred into keywords. The keywords were imported into Mind Jet Manager where they were then analyzed to find patterns and categories. With the background in these patterns and categories a data structure was established.

After establishing the data structure and categorization system, the individual interviews were analyzed accordingly. The original transcript was analyzed and relevant parts of it were copied to the matching categorization. From this collection of transcript quotes keywords were identified and a full text was written to summarize the findings for the relevant category.

As this was done in large tables on A3 sheets, it provides transparency to the research, when reading the individual interview one can easily go back to the relevant transcript parts, and review or question what the full text says.

The cross analysis of the interviews was done by taking keywords from same categories and comparing these between the agencies. Also the full text from the individual analysis was used.

6 RESULTS

Sustainability is a wide term, which can be and is interpreted in many different ways. The interviewees’ interpretations of sustainability were analyzed with respect to the People Planet Profit, 3P, definition of sustainability. The interviewees’ interpretations were found both by direct questions and indirectly through transcript analysis. All aspects of the 3P definition were found in the study: all agencies associated planet concerns with the term, 3 of the companies associated people issues with the term. All the companies expressed that sustainability should be value adding, thus indirectly confirming profit.

No matter the motivation, all the agencies were clear on the fact that it had to be a valid business case, they had to provide value to the client. The “intrinsically motivated” companies did however seem more prone to actively seek after these situations.

At all the agencies, sustainability was project dependent, both with respect to whether or not sustainability was an issue at all in the project and if so, what measures were carried out. However certain characteristics and strategies towards sustainable design were identified:

- **Shifting paradigms and mindset:** With sustainability, as with products in general, agencies aim to shift paradigms and change people’s mindset. They are aiming for radical innovation that can facilitate change and in the end, result in more sustainable solutions.
- **Indirect approach:** By evaluating products entire life, avoiding throw-away products, prolonging lifetime and assessing product’s end of life, agencies address some of the main issues of sustainability.
- **Hidden sustainability:** Agencies try to make sustainable ‘wise choices’ in detail design, even if this is not something they necessarily showcase to either the customer or the client.
- **Good design:** According to agency 3 sustainable design does not really differ that much from ordinary design. Sustainability is not only about rational arguments like “the world is falling apart” people want to be seduced; sustainability should also be smart and sexy. One should think ahead, see the system as a whole to avoid product abuse and other pitfalls that might lead to problem shifting or boomerang effects. This also matches with what agency 2 says: “I don’t think it’s just about designing a sustainable product; it has to be a good product”
- **Knowledge center:** Due to increasing client interest about sustainability, agency 2 decided to learn more about it, to do this they formed a knowledge center together with other companies and institutes. One of the results of this cooperation is a tools set of 10 different eco design tools, which are organized according to time and budget. If a client shows interest for sustainability, they can, depending of the
project at hand, easily evaluate what tools are suited for the project. Some of the tools in the set are: LCA, Compact LCA, cost price optimization, and construction optimization.

- Product driver: sustainability can be used as strategic product drivers, most commonly for marketing reasons where it can be used as a differentiator in market, or as a driver for the product image.
- One factor among many: sustainability is something than can be incorporated into the product when it offers an advantage to the project. It is important to remember that sustainability is one factor among many others: price, quality, looks and other criteria’s must also be met. Sustainability can affect these issues both in positive and negative ways.

### 6.1 Agency-driven vs. client driven sustainability

Sustainability in a project can be initiated either by the client or the agency. There is a significant difference between projects where sustainability is client-driven vs. projects were it is agency-driven. In client-driven cases, that is; if the client asks for sustainability, it will be among the project drivers from the beginning, as a result the agency will search actively for sustainable solutions from day one. In the case that the client does not express any wish or desire for sustainability, it is still possible that the agency may bring sustainability to the project. However in this case the client must be made aware of it, be motivated for it, and the agency needs to come up with both ideas and solutions that fit with the project.

With sustainability as with many other topics, such as design for manufacturing or economics, there is often a knowledge gap between the client and the agency. As one agency said: “As a designer it is your responsibility to bring in subjects that can make a better product in the end, sustainability is just one of these subjects”.

### 6.2 Drivers for sustainable design

Sustainable design was motivated by several different drivers; some that were identified in the interviews are presented below. One should be aware that these will often work together with a synergetic effect.

- Intrinsically motivated. Sustainability for the sake of sustainability.
- Cost savings. Reduction of weight, volume, material consumption, energy, packaging and parts, reduces both cost and environmental impact.
- Market differentiation.
- Image, and cooperate identity.
- Good design: Good design is also sustainable.
- Product quality. Making durable quality products improve product life time and please the customer.

- Government incentives and purchase rules.
- Attract clients. Sustainable design is an area of expertise the agency can sell to sustainable aware clients.

### 6.3 Sustainability barriers

Some of the agencies were concerned about extra costs or added complexity associated with sustainable design. Some of the factors they described are shown below.

- Experience. In the case that sustainable design is new to a company it does represent uncertainty and thus risk. Also if it is new it involves a learning curve and one is not able to draw on old experience, this makes sustainable design appear more difficult compared to design as usual.
- Time. Sustainable design takes time, and times is money.
- Material issues: Some “sustainable materials” are more complicated or have higher purchase or production cost than non-sustainable alternatives.
- Redesign: While end product might not cost more, the redesign process costs money in itself.

Most of the agencies have both long and short term clients. Some clients have been working with an agency for long periods of times (10, 20 years or even since the agency was formed), other clients might only stayed around for one project.

Having long term clients is a benefit for several reasons, repeating customers are good for business, but also gives the agency better knowledge about the client (market position, interest, products, organization goals) and the client knowledge about the agency (what they can do, work style and so on). Both of these makes for a better cooperation between client and agency and in the end, also better products. In some case this can lead to long term strategic relationships between client and agency.

### 6.4 Sustainability entry point in the project

All of the interviewees agree that sustainability is more effective if it enters the project in the early stages. Sustainability preferably should be thought of early in the process: If it becomes an issue in the pre-construction or engineering phase (material embodiment) it might be too late to implement. Thinking of it in the concept phase is better, but for the optimal effect, it should be thought of in the early stages such as vision or branding. When the goal is to do something sustainable, the concept development takes on a different direction which makes it more effective. The earlier into a project sustainability becomes an issue, the higher the effect of this choice will be. If sustainability is a goal from the front phases, the entire process takes on a different direction.

Summarized and simplified sustainability enters the projects in the following phases:
• Strategic/Front End: if is it client-driven, or it is found to be a project driver as a result of strategic design
• Concept/creative: Sustainability may enter the process as part of a creative/exploratory work
• Engineering: Wise detailing/engineering decisions
• Too late: if it enters too late, it might not be possible to incorporate at all

6.5 Project Definition and brief
Defining the project is like a project in itself, agency 4 says, “It’s about creating structure, but this structure should be different in every situation depending on the client’s needs or wishes.” One needs to define exactly what one will make and what it is going to do. This includes big strategic decisions like; functionality level, marketing and technology. At the same time one needs to make an outline or a plan, do cost estimates, decide on tool use and find delivery dates.

“The choices that you make in the front end make a very big difference not only for sustainability but for everything”

Agency 2 says the brief should address central key issues and project drivers, which are found in the analysis phase (strategy front phase). Sustainability can be one of these issues, but in more specified terms, such as design-for-x, so that is better suited to answer added value questions. The brief is a working document that adapts during the project. Often the original brief is too simple and straightforward and needs adjustment to make it fit the project.

One can distinguish between open and closed briefs, in open briefs, the outcome of the project might not yet be clear, and the agency will have considerable room to maneuver and look for different possibilities. A closed brief tells the agency more or less exactly what they should do and there is not much room to deviate from this.

6.6 Decision making / selection process
Agency 1 says that while the creative process might be quite similar to what taught in D-school, the selection process is much more unstructured. Agency 1 does not have faith in Harris profiles and similar tools that divide the concepts into smaller pieces, judge the parts and by them judge the product as a whole. It is easy to cheat with and gives an untrue image that one has a good judgment over the project. In reality, as a concept has many things that are not yet explicit, intuition might provide better judgment than “a scientific method”. Agency 1 tries to look at the most important requirements and see if they are met, but they do not try to measure it. They do try to rationalize to a certain aspect, but believe that since one cannot rationalize to 100% one should not even try. In the end different ideas are discussed between people and usually the client has the final word.

“Selection is always the hard part” agency 2 says. They do not use any specific tools for selection. What they do, is to hold the ideas against the results from the analysis and see whether the concept/idea is a good answer to the problem. Agency 2 says this is to a large extent experience-based. Sustainability is handled like any other idea; if it comes as result of the analysis phase, it will be a selection criterion.

7 DISCUSSION AND CONCLUSIONS
This study has shown that there is a significant qualitative difference between client driven and agency driven sustainability in design agencies. Furthermore, this seems to be closely connected with the entry point of sustainability in the design process, and whether or not sustainability is among the product drivers. In the case of client driven sustainability, it will be present from the front end of the project and also as a product driver.

In cases, where no original client request for sustainability was made, it has been shown that an agency still may initiate what this paper calls agency-driven sustainability. However in this case the client must be made aware of it, be motivated for it and the agency needs to come up with both ideas and solutions that fit with the project. In such a case sustainability is usually associated with an opportunity for synergy effects with the original product drivers. Thus, it represents an added value for the client.

In the study, there was a focus on entry point of the sustainability within the product development process.

Further, it was found that which phases of a project are conducted by the client (or other party) and which are conducted by the agency can vary significantly between projects, and that this may depend both on agency strategies and client strategies. In the case that the agency found opportunities for sustainable drivers in a project, this would be handled differently in a front end / strategic project compared to a project where the opportunities emerged as a result of creative processes in later stages.

There also appears to be a connection between the “openness” of the brief and the chance for agency driven sustainability, open briefs allows for more wide and creative idea searches and thus increases the chance of finding opportunities/ideas that are not mentioned in the brief.

A final observation is that sustainability often appears to be dealt with on a decomposed level, i.e. focus on material reduction, or energy efficiency, and not on the holistic concept of sustainability. This was found for sustainability as a project driver, as well as for opportunity searches for potential synergy effects.

This study, which was a master’s graduation project [9], has been executed as a first exploration of the practices of design agencies with respect to sustainability within the front end of innovation. In connection to this study, a
range of other activities has been undertaken, which are described in the final section.

8 FURTHER RESEARCH

Following the exploratory study described above, several follow-up studies have been undertaken. One such follow-up is an in-depth project with a single design agency [10], aimed at studying how a given agency might incorporate sustainability effectively in its daily practices.

Other follow-up projects are in the form of explorations in different geographical settings, such as Belgium and the US [11,12,13], which is part of a PhD research project on the topic of sustainability within the front end at design agencies.

Another follow-up study was executed among Dutch design agencies by utilizing a different sampling approach. A publication from this study is forthcoming. The study presented here used a sample based on the leading product design agencies in the Netherlands. Within those agencies, the full spread of projects was explored. Hence, the results of this project form an indication of mainstream practices within the Netherlands with regards to sustainability within the front end of innovation. The follow-up study sampled agencies that actively position themselves as sustainability-driven, and within these agencies the focus was on best-case examples. Hence, that study represents the best practices within the Netherlands.

This follow-up project was executed in collaboration with the Dutch union for professional designers, the BNO. With them, also work on diffusing sustainability knowledge amongst Dutch Design agencies has been studied, in connection with their on- and offline platform the ‘groene offerte’ (‘the green bid’) [14].

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REFERENCES