# TOOLKIT THAT SUPPORTS THE DEVELOPMENT OF A SUSTAINABLE PRODUCT-SERVICE SYSTEM

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## ABSTRACT

This study results from a master thesis for the Department of Product Development of The University of Antwerp. The thesis focuses on a toolkit that provides support in the design process of a PSS, namely the product-service system design toolkit [1]. In this toolkit, there is hardly any focus on sustainability, but rather on the interaction with the end-user. To integrate this sustainability aspect - considering people, planet and profit - the Sustainable Innovation System (SIS) toolkit of OVAM [2] is used as input. The opportunity of this master thesis is to work out a possible synergy of both toolkits. This type of toolkit is hardly explored in the current market. This paper will first find out how both toolkits are used and what pitfalls there are. Various research methods have been used to map out the findings: a literature exploration, analysis of existing evaluations, in-depth interviews, a focus group, online questionnaires, a workshop, and project guidance. The triangulation ensures that the results are as close to reality as possible. This information is summarized and translated into drivers for the solution to be designed. After this, a proposal for the solution is being presented, which is a digital library of design tools. This study thus contributes to a concise human and economic analysis of design tools in general, and a proposal – specifically for the PSS design toolkit and the SIS toolkit – of automated project guidance for design students and practitioners. The online tool platform emerges as the best solution for the abovementioned problems and considers five design drivers that guide the design process, namely: design track support, autonomous use, reduced complexity, universal use, and easy integration.

*Keywords: Tool, toolkit, design methodology, product service system and sustainable design*

## 1 INTRODUCTION

This master thesis starts from an externally provided theme related to two design toolkits. On the one hand, the PSS design toolkit [1] supports users in the design process of a PSS using 31 different tools. A Product Service System (PSS) is an example of a sustainable solution on a systemic level. It is a system of products and services that together can fulfil the needs of a consumer through innovative cooperation between stakeholders. A PSS can bring about a shift from owning to consuming, which responds to the scarcity of our resources. Unfortunately, this toolkit has little regard for sustainability but instead focuses on the interaction with the end-user. This approach is being criticized today: if sustainability can be involved as early as possible in the design process, the impact is maximised [3]. To develop sustainably, designers need tools and methods that can guide them through the design process. This is where the second toolkit comes in: the Sustainable Innovation System (SIS) toolkit of OVAM [2]. The purpose of this toolkit is to implement innovations sustainably. The toolkit is provided by certified facilitators and consists of 30 individual tools divided into different capitals of sustainability. The main principles of this master thesis are: how can both toolkits reinforce each other and how to reduce the barriers for using the toolkits? Besides the fact that the solution must support the development of a PSS, sustainability must also be integrated as broadly as possible.

## 2 CONTEXTS

Today, sustainability is hardly ever included in design toolkits, as the analysis by José, Rui and Fernando [4] shows. Talal Rafi, a business council at Forbes magazine, indicates that companies struggle to concretise a sustainable approach [5]. Although 90% of executives recognise the importance of sustainability, only 60% of companies have a sustainability strategy. This also confirms the need for concrete applicable tools.

## 2.1 Competing toolkits

To start with, the current context of the toolkit market is being analysed. An overview is made of toolkits that support designers to realise developments in a sustainable manner. To make the inventory of existing toolkits, the following search terms were used: 'PSS development toolkit', 'design a sustainable PSS', 'sustainable design tools', 'instrument for sustainable design' and 'instrument for sustainable PSS'. The toolkits are then placed on a product & system axis. The result of this mapping is shown in figure 1. This overview is not complete but gives an indication of the sustainable toolkits available on the market.
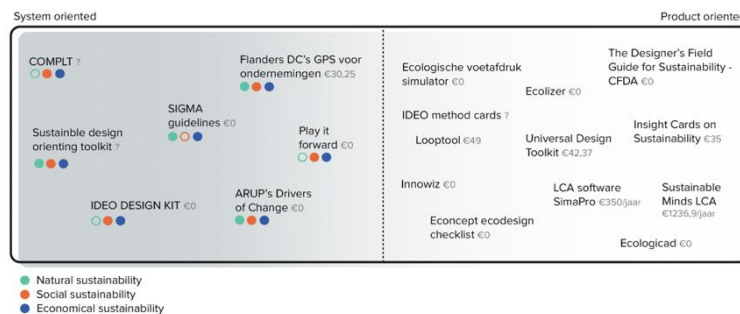


*Figure 1. Competitive toolkits on a product/system axis*

First of all, there are more toolkits available for designing products than for systems. When taking a closer look at the toolkits with a predominant system focus, it becomes apparent that most of them have a different ambition than the solution being developed. They do not help in the exploration or development of new Product-Service Systems. Furthermore, for the available toolkits with a predominant system focus, it is shown which aspects of sustainability are integrated. This shows that the broad spectrum of sustainability (people, profit and planet) is only included in a limited number of these toolkits. Finally, the price (if available) of the various toolkits is also placed in the overview. From a market perspective, this analysis shows that there is room for an immediately applicable tool that provides support in the design process of new sustainable product-service systems.

## 2.2 Business models of toolkits

The various business models used for toolkits are also examined. These can be divided into paying and free models for the users. The most traditional way in which a tool can be provided is through the sale of a physical product. This can take various forms, including a poster, cards, a book or a game. This usually involves a fixed price. Tools and instruments can also be incorporated in a software programme; the revenue model then often works based on one-off or annual licences. It is also possible that a tool is offered as a workshop with the necessary guidance. In this case, the tool itself is enhanced by the expertise and a high fee is often charged for that expertise. A tool can be downloaded online and thus be considered 'open source'. This often involves templates, maps or a manual that can be printed out yourself if desired. Another way of offering a tool for free is via a web page that the user can interact with. This way, there are online maps, completion templates, etc. Often different business models are combined into a hybrid toolkit.

## 3 RESEARCH METHODS

According to Conole and Oliver [6], a toolkit is judged by its usability. This results in the user being responsible for the assessment of a toolkit. Both toolkits are therefore submitted to a human analysis. This implies looking at how the users deal with the toolkits and what user problems are observed.

For the human analysis of the SIS toolkit, four different research methods were used. First, an analysis of the internal documentation provided by OVAM concerning the design process and the evaluations already carried out by OVAM and partners in 2013-2014. This includes an online survey on the SIS toolkit, completed by 19 out of 32 certified supervisors with questions mainly related to the support and dissemination of the toolkit. Furthermore, recommendations from Studio Spark, the study agency that piloted the SIS toolkit were also available. Finally, a general customer survey on the eco-design practices within OVAM was carried out by a former policy innovation team. As part of this survey, OVAM

partners were questioned about various eco-design tools. Secondly, in-depth interviews were conducted with Philippe Vandenbroeck and Wim Van Den Hende, the two designers of the SIS toolkit, as well as with Filiep Dewitte and Thomas Vandenhaute, two facilitators certified for using the toolkit. Thirdly, a workshop concerning the SIS toolkit was organised for the 1st master students of product development as part of the Integral Product Design course. Information was collected during this workshop through observations and conversations with the students. Finally, an online survey was sent out to the users of the SIS toolkit. For this purpose, a mail was sent to 86 users. These are the people who have ordered the toolkit since January 2021. Since enough rich information had already been collected beforehand, this method is only used for verification. The results of the open-ended survey reflect the problems experienced by 7 of these users.

The PSS design toolkit has been analysed at the human level using the following three research methods. First, in-depth interviews were conducted with users of the toolkit in the field. These were Maksim Sayevitch, a product development alumnus who has been active in the industry for five years, and Bart Melort, an architect and lecturer in architecture at Ghent University. Next, a focus group was organised with four students who are in their 2nd master's year of product development and have chosen Strategic Design as major course. Each of them went through the PSS design toolkit - in a different project - during the Integral Product Design course. During the focus discussion, a template or short explanation of each tool was laid out on the table. First, the participants individually filled in the predefined evaluation form, giving each tool a score out of 10 and indicating which of the factors of the creativity support index [7] apply to it. These 6 factors are collaboration, fun, exploration, expressiveness, immersion and worthwhile results. After this, the group discusses the tools. The evaluation form is mainly used to form a personal opinion and to start the conversation afterwards. The scores on the form are indicative and are not processed as such. Finally, some general questions were asked. The final research method consists of the project supervision of the 1st master course Integral Product Design, which also provides insights in the use of the PSS design toolkit. In this course, 24 groups of 4 students systematically go through the PSS design toolkit, to support the design process of a PSS within the theme of student life experience. Students are not explicitly asked about this, but they do ask questions and spontaneously share their opinions about the different tools.

## 4   FINDINGS

The results are divided into 4 sections: results human analysis SIS toolkit, results human analysis PSS design toolkit, general results human analysis and design results. Obviously, both the SIS toolkit and the PSS design toolkit have their specific pitfalls. However, there are also overlapping issues that users experience with both toolkits, and that apply to toolkits in general. The section 'design results' covers the implications of these findings for the solution aiming at creating a synergy between both toolkits.

### 4.1   Results human analysis SIS toolkit

The interviewees notice in recent years a greater sense of urgency regarding sustainability among companies (Van Den Hende and Vandenbroeck, 4 November personal communication 2021; Filiep Dewitte, personal communication, 10 November; Thomas Vandenhaute, personal communication, 28 October). They are therefore often looking for concrete guidelines. Unfortunately, they cannot find these in the SIS toolkit. The toolkit is strong in content and theory, but poorly applicable in practice. Furthermore, users did not expect the toolkit to be so strategic and were often looking for something concrete to support them.

The toolkit overwhelms users with a multitude of information, partly due to its clumsy materialisation and huge manual.  It requires a lot of preparation time to go through everything before users can get started. It is too complex to take the first steps and is therefore mainly used as a theoretical framework. The three large posters are inconvenient to use, for example, 70% of the surveyed supervisors score the user-friendliness only neutral.

The SIS toolkit requires a high level of general knowledge about sustainability. This statement is supported by the fact that 62.5% of the surveyed supervisors say that guidance is necessary.  The toolkit was made available through certified facilitators. Van Den Hende and Vandenbroeck (personal communication, 4 November 2021) are not satisfied with the go-to-market strategy used. They see more potential in an open-source community with a low entry threshold instead of a protective marketing strategy with certified supervisors Another observation is that users' priorities are not equally distributed over the different capitals, e.g., intellectual capital is considered less important. Also, users need a value

chain that can map the cooperation between partners and ensure a circular system. Finally, the content of the SIS toolkit needs to be updated, as the information dates to 2011 and many new sustainable strategies and tools exist in the meantime.

## 4.2 Results human analysis PSS design toolkit

For the tools of the PSS design toolkit, the added value and purpose is not always clearly defined. In some cases, the thought process behind a tool is useful, but the tool is not the right way to support this thought process. Some tools within the toolkit are less suitable than others. The PSS design toolkit can be applied more broadly than just for designing a PSS; Bart Melort made a small adaptation of the toolkit for an architecture assignment. In general, users do not always agree with the order in which the tools are described in the process. Some tools have a lot of overlap and the order in which the tools are presented needs to be changed. Also, the toolkit falls short in idea generation tools and the idea generation phase is often too short for users. They would like to see more tools implemented in the toolkit to be able to present the widest possible range of ideas. This feedback has led to the selection of the tools to be included in the solution.

## 4.3 General results human analysis

The interviewed experts point out that every design process is unique and needs flexible tools that can be easily implemented in a company's current design methodology. As both SIS and PSS design toolkit are physical toolkits, their flexibility is more limited.

The observations of the use of the tools showed that not every user has the same approach when it comes to toolkits. On the one hand there are users that like to take a lot of initiative; they start working with tools themselves with limited explanation. They interpret tools in their own way and dare to deviate from the prescribed tools. If necessary, they will also look for alternative tools themselves. On the other hand, there are also users who tend to wait; they ask more questions about the application of a tool and need clear guidelines and examples. These users are stricter with the imposed tools and do not like to deviate from the process. Yet both types of users need clear objectives: what is the overall purpose of the tool/toolkit and what kind of output can they expect.

Finally, within both toolkits, there are tools with various levels of abstraction. Some tools have a high level of abstraction, these are theoretically strong and more generic. The tools with a low abstraction level are concrete and directly applicable tools. Within a tool or toolkit, there is always a tension of the level of abstraction. Finding the right balance is essential here. Often examples or concrete business cases are missing, while these could help to lower the level of abstraction for users.

## 4.4 Design results

From the results of the human analysis, design drivers were determined. These describe the most important characteristics that guide the solutions to be designed in this master thesis. To start, the solution supports the design process of a sustainable product-service system. It is therefore not a loose collection of tools but focuses on guiding the process. Secondly, the solution is self-managing and can therefore be used fully independently by both initiative-taking users and users looking for more guidance. Thirdly, the complexity and level of abstraction are reduced. This means that even someone without expertise in strategic tools or sustainability can use it. Fourthly, the solution is flexible and can be used for any project theme. Finally, the tools must be easy to integrate into a company's current design methodology. Subsequently, the idea generation process resulted in four ideas for possible solutions. These should provide an answer to the question of how both toolkits can reinforce each other and how to reduce the barriers for using the toolkits?
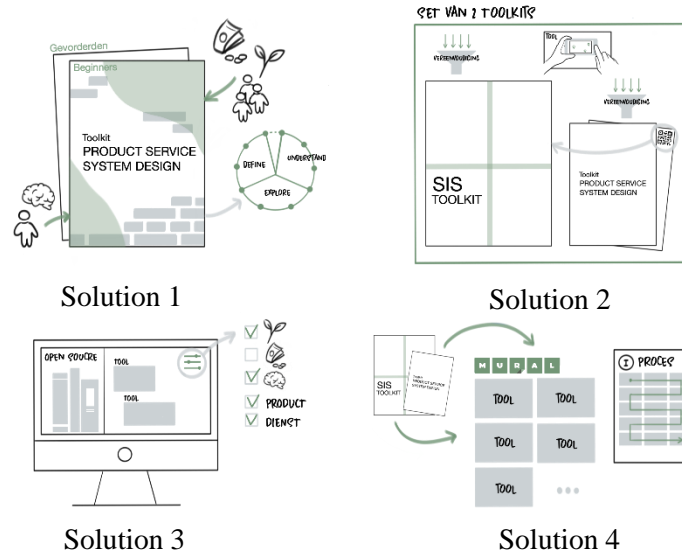
Solution 1      Solution 2

Solution 3      Solution 4

*Figure 2. Solutions 1 to 4*

These four solutions have each been evaluated based on the design drivers (Figure 2). The driver complexity has been left out of consideration, as it mainly influences the tool's content and less the way the synergy of both toolkits is made possible.



*Figure 3. Trade-off of solutions 1 to 4*

In this assessment, solution 3 emerges as the best (Figure 3). This proposal supports designers in a sustainable and balanced design process based on an online tool platform.
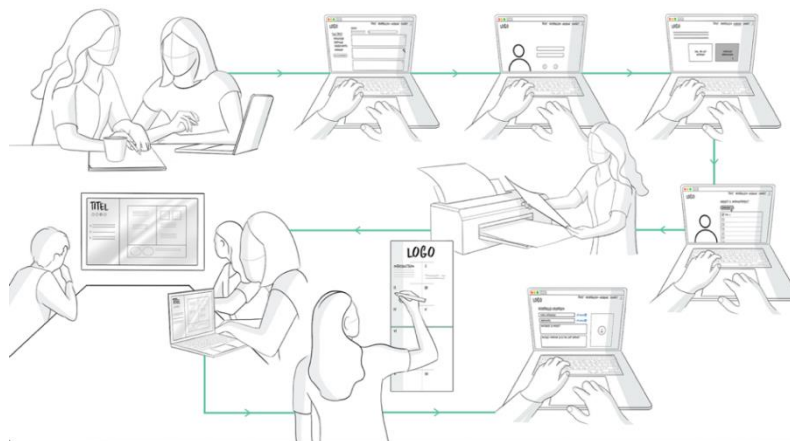


*Figure 4. Visualisation of the user scenario*

Hereby, users can search for tools by means of two search strategies. They can either select tools themselves by using different filters or they choose to get help from the platform. In the second option, they must answer some questions and the platform proposes one of the standard design trajectories. Users can then save tools or complete projects on a profile. They can also set personal branding to be applied on the tools. Before they get started, the facilitator of the workshop can find more information on the platform: about the purpose of the platform, the different components of the platform and tips on organising workshops. Users do not receive a physical toolkit but can download files for free. These downloads always contain the template of a tool (if present) and an overview of the selected tools. Users can print the overview, which contains information about each tool, and users can also supplement this

with their own written conclusions. Finally, users can also upload example projects to inspire other users. There will be a LinkedIn link to the project and the designer or company concerned. In this way, a community is created in which users can ask questions and inspire each other. It's also a positive advertisement for the designer or company involved.

## 5   DISCUSSIONS

The results of this study would be more reliable if a larger population was surveyed. The PSS design toolkit is still actively used by students and in the field. However, this is not the case for the SIS toolkit. It was released in 2011 and has not quite taken off as expected. The sustainable mindset required for active use of the SIS toolkit was not sufficiently present among companies when it was launched in 2011. In addition, the toolkit was not delivered to companies that were already making efforts with regard to sustainability. Also, working with an external facilitator creates an extra barrier for companies, as it is difficult to deal with confidential information. Moreover, the use of an external facilitator often has an influence on the price and the accessibility of a toolkit. At this moment, the tools are hardly used. This timeframe and the lack of intensive use made it difficult to conduct in-depth interviews.

Interviewees According to Sayevitch's experience (personal communication, 26 October 2021), new tools in the corporate world are not always warmly welcomed by management. "The PSS design process is not that complex, but habits have been built up that are very difficult to break with something completely new. To break habits, one has to give something very handy to decision-makers". Meaning that there is a need for practical, immediately applicable tools that prove their added value in the short term. Moreover, they must be flexible and easy to apply per project. A toolkit should be approached as a circular or iterative process, whereby tools sometimes need to be repeated several times to achieve a good result.

## 6   CONCLUSIONS

The competitor analysis shows that there is therefore room for an immediately applicable tool that provides support in the design process of new sustainable product-service systems. The human analysis shows different problems for each individual toolkit and for toolkits in general. To work out the solution, these problems are taken into account by listing 5 design drivers that guide the design process, namely: design track support, autonomous use, reduced complexity, universal use and easy integration. After idea generation, the solution of the online tool platform emerges as the best.

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