Gamification as a Means to User Involvement in Decision-Making Processes for Sustainable Buildings

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ABSTRACT

User ownership, actors' and stakeholders' lack of knowledge is often identified as critical success parameters and barriers when evaluating how well sustainable buildings perform. Recognising that it is impossible to drive sustainable development without the people who pay for sustainable buildings, and the people who run and use these buildings, the development of a dialogue and prioritisation tool was funded by the Danish Ministry of Immigration, Integration and Housing. This paper presents the tool development process that is a result of a participatory research and development process where the tool was developed by a multidisciplinary group of stakeholders and actors from the Danish building and housing industry. The paper presents how gamification can be used to make complex and academic issues of sustainability available to decision-makers in housing organisations who are typically people from all walks of life.

Design thinking was used as method to develop a tool that focuses on how to make sustainable strategy development accessible to non-specialists during those critical stages of building design processes when goals and prioritisations are set. The tool is based on an open and editable platform and it will be available to the public in the early Summer of 2017. The paper presents how design thinking is used as an engaging research and development methodology, as well as, an introduction to the dialogue and prioritisation tool's content and format.

Keywords: community empowerment, affordable housing, decision making process

1. INTRODUCTION

In August 2013, an open two-stage architectural design competition was launched under the title 'Future Sustainable Public Housing'. The project owners, selected by the Danish Ministry of City, Housing and Rural Districts, were the two Danish housing organisations, 'Lejerbo' and 'AL2Bolig'. The Danish version of the DGNB system [2] was described in the competition material and the project owners hired a DGNB consultant to initiate a pre-certification of the competition projects that were selected for participation in stage two of the competition. During this process the DGNB tool was introduced to the project managers from Lejerbo and AL2Bolig and the residential decision-making construction committee at AL2Bolig. During this process it became apparent that the DGNB system was too academic and complex to enable easy communication with decision-makers in the housing organisation. Because of this, the director of AL2Bolig initiated the idea to develop a dialogue and prioritisation tool for user-involvement on sustainability strategy development for social housing. In late 2015, The Danish Ministry of Immigration, Integration and Housing decided to fund the tools' development.

1.1 Decision-making in Danish housing organisations

The social housing organisations in Denmark depend on subsidies for renovation from "Landsbyggefonden", governmental subsidies for new constructions, as well as, municipal planners who determine where housing projects are to be built and how they are financed. Because of the public subsidies, and the fact that the tenants carry most of the investment in new buildings, Danish housing organisations are based on residential democracy where the residents elect their peers as members of the board and different committees. The residential democracy is supplemented by professional staff consisting of a director, a communication department, tenant management, technical staff and facility managers. How the residential boards and committees are involved in decision-making on building projects vary a great deal depending on the housing organisations. In some organisations the residential democracy is greatly involved in the decision-making processes. This means that in some cases residents with very different educational background will have a great impact on the sustainability strategies for

building projects thus making it necessary to communicate with the residential democrats about complex and highly specialised knowledge.

1.2 Project organisation

The project was organised as follows: A work group was established that refers to the Danish Ministry of Immigration, Integration and Housing. An advisory board and a test group were established as advisors to the work group. The work group consists of two building design engineers, a social housing expert and the following representatives from two housing organisations: a director, a technical chief and a communication team leader. One of the members in the work group is the project owner who refers to the Danish Ministry of Immigration, Integration and Housing. The advisory board is interdisciplinary with representatives from the work group and the following roles: Architect, engineer, technical chief and project managers from housing organisations, contractors, municipal plan chief, residential democrat and technical reviewer from the Danish Green Building Council. The test groups consist of project managers from five different housing organisations and a group of residential democrats with very different background and skills who were elected by their peers for decision-making on building projects in their respective housing organisations. The purpose of the multidisciplinary workgroup and advisory board was to ensure that all relevant actors from the building industry could contribute with their experiences and ideas in the tool development process whilst the selection of people for the test group focused on ensuring that projects managers and residential democrats from very different housing organisations would test the tool. This was chosen to ensure that the tool is applicable by housing organisations with very diverse backgrounds.

2. TOOL DEVELOPMENT METHODOLOGY

2.1 Design thinking as a methodical approach

Design Thinking was used to facilitate the development of the dialogue and prioritisation tool. The term Design Thinking (DT) is often used as a way of describing how designers think. David Kelly, IDEO, is amongst the pioneers behind the notion of Design Thinking in business development projects. IDEO explains DT like this: "Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success." (Brown, September 20th 2016). Prior to the launch of the term design thinking researchers like Professor Bryan Lawson, Sheffield University, and the laid Professor Donald Schön, Massachusetts Institute of Technology, were some of the main authorities in the field of how designers think. The referenced paper by Hansen and Knudstrup (2008) concluded that designers and engineers traditionally approached problem solving in different ways where the designer reframed the design problem continually throughout their process whilst engineers tended to stick with the original problem and test different hypotheses for how to solve the problem. Today DT is a commonly used term that is applied to many disciplines including engineering and the disciplinary boundaries between architectural design and engineering have therefore diminished. When developing the dialogue and prioritisation tool a model of design thinking, developed by the Danish Design School in Kolding, was utilised. The model shown in Figure 2 was chosen because it builds on the theories behind design thinking and visualises when open and closed modes are utilised in the project and product development.
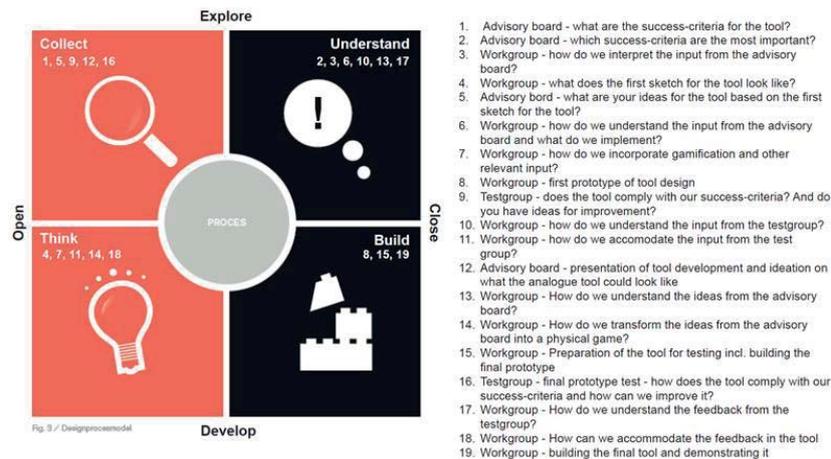
2.2   The tool development process

Figure 1: The tool development process mapped via numbers added to the "Design Process Model" from the Danish Design School in Kolding

The dialogue and prioritisation tool development occurred in four phases with a total of 19 activities where each phase included open and closed modes in the Design Process Model from the Danish Design School in Kolding. These activities are added as a new layer with numbers in the Design Process Model (please refer to Figure 1).

3.   THE NEW DIALOGUE AND PRIORITISATION TOOL

The idea of basing the dialogue and prioritisation tool on gamification originates from a meeting with the advisory board where some of the advisory board members explained how using the DGNB system on projects had resulted in a sense of competing with oneself and how this increased the project actors' engagement and commitment to increase the features of sustainability in their projects. The reasoning behind the decision to gamify the dialogue and prioritisation process was that 1) Physical interaction with objects will make the decision-making process more engaging and 2) Visualisation of qualitative performance at an early stage is an important driver that makes stakeholders compete with themselves. Gamification was therefore selected as a means of using the DGNB system to turn sustainability into measurable parameters thus quantifying and visualising the decision-making effect on social, economic and environmental sustainability. Gamification is thus in this instance defined as an interactive strategic decision-making process where the results of qualitative decisions are quantified and visualised as a driver for a better dialogue about sustainability and hopefully more holistic sustainability strategies [10]. The element of gamification in the tool is therefore essentially the situation where the decision-makers gain increased insight into sustainability aspects of building design and compete with themselves to improve the project performance.

To ensure that the actors focus on strategic decisions rather than immersing themselves into specific solutions the tool contains two components; 1) A digital tool programmed in Microsoft Office Excel for project managers in housing associations and 2) A dialogue tool number of physical dialogue and prioritisation cards that are to be used at a workshop with different actors from the housing organisations. Physical objects in the form of different coloured Centricubes are assigned to each corresponding coloured dialogue and prioritisation card. The number of Centricubes roughly corresponds with the influence that the specific dialogue card has on the environmental, social, economic, technical or process quality in the DGNB system. The purpose of these objects is to visualise how the conclusions of the decision-making process affect the project's sustainability.

Figure 2 shows a picture of the new analogue dialogue and prioritisation tool used in the prototype test in November and December 2016. The dialogue board and the questions on the cards are under revision after the prototype test but the essential elements of the tool described in this paper will be preserved.

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Figure 2: The new developed analogue dialogue and prioritisation tool used in the prototype test.

3.1   Tool content

As mentioned in the previous paragraph, the tool consists of two components, a digital platform for the project manager and an analogue platform to be used by the project manager in dialogue with the residential democrats in the housing organisation.

The approach taken to sustainability in the tool is the Danish version of the DGNB system. The challenge one faces when trying to use the DGNB system in communication with non-specialists is that the system is perceived as very academic – i.e. very theoretical and abstract – and very unapproachable by non-specialists. This makes sense seen in the light that one needs to have at least 2 years of practical experience prior to completing the training to become a DGNB consultant. It is however a significant barrier when it comes to ensuring ownership and engagement with non-specialists in the decision-making process. Because of this the DGNB system has been transcribed into the themes listed in Table 1.

Quality	Themes
Environmental quality (green colour)	Materials, Energy, Water, Biodiversity, Pollution management
Economic quality (blue)	Life cycle costs, Flexibility, Durability and robust solutions
Social quality (orange)	Quality of outdoor areas, Indoor climate, User control, Accessibility, Safety and security, Cyclist facilities, Architectural quality, Functionality and planning
Technical quality(yellow)	Fire management, Building envelope quality, Cleaning and maintenance
Process quality (purple)	Project planning, Integrated design process, Integrated concepts, Responsible contractors, O&M material handover, Construction site operation, Onsite measurements, Commissioning

Table 1: List of DGNB themes referring to the different colourers in the tool

Communication with the residential democrats is based on these themes and a number of topics related to each of these themes. Examples of topics related to the theme Materials are: design for disassembly, environmental impact of materials, embedded toxins and responsible procurement. For each of these topics there is a short explanatory text that describes 1) What this topic has to do with sustainability and 2) Which type of value it adds to the projects social, environmental and economic sustainability. Each topic has at least one question that the residential democrats are asked to discuss and prioritise on a scale of three levels of importance. Depending on their answers the actors will place the Centricubes belonging to the specific dialogue card in one of two fields at the dialogue board 'prioritised' and 'not prioritised'. The purpose of this exercise is to visualise how different types of sustainability is weighted by the dialogue partners as well as an identification of the remaining potential to improve the project's sustainability. The project manager will mark the selected answer for each question in a table that he/ she has printed from the digital tool in case the dialogue partners wish to change their minds and change the project's prioritisation of a specific topic.

After the workshop the answers to each question is transferred to the digital tool and translated into a series of graphs that show how the project is expected to perform against the DGNB system. It is also possible for the project manager to add his or her own weighting to each theme if they do not wish to adhere to the weighting of the themes in the DGNB system e.g. if they have chosen to disregard some of the themes in their project. Once the dialogue process has been completed the dialogue tool translates the questions and answers for each topic back into the DGNB system's structure as part of the preparation of the tender material. This is done to ensure easy communication with DGNB specialists that have to reply to the upcoming tender.
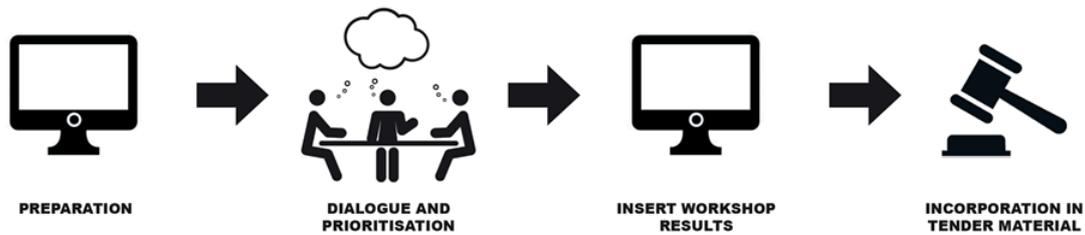
3.2   Tool application

Figure 3: Overview of the tool application process.

The tool is applied in the following manner:

- The project manager fills out a form with background data and contextual questions about the project's preconditions including which actors he wishes to include in the dialogue process.
- Based on his or her answers the list of themes are sorted by the digital tool and for each of the themes listed by the tool the project manager selects which actor or group of actors to include in the decision making process for each theme.
- Based on step 2: The tool divides the topics, questions and answers for each theme into separate sheets in the tool. This is where the project manager will insert the results of the analogue dialogue process.
- Based on step 3: The project manager divides his/her dialogue cards into piles for each actor or group of actors that he/she wants to involve in the decision-making process. He/she also divides the number of Centricubes into piles and brings these with the rest of the dialogue tool to a meeting or a workshop with these actors.
- At the workshop each card is prioritised on a scale of three levels that define the importance of the card's topic. Each card has a colour that tells the dialogue partners whether the topic has to do with social, environmental, economic, technical or process quality. The project manager can also choose to bring the coloured Centricubes that correspond to the weights of each card and use these to build an image of how the selected strategy performs for each of the 5 qualities in the DGNB system. If this is included in the dialogue process the actors will receive instant feedback on how their choices influence the future sustainability of their project. The type of sustainability is marked via the coloured Centricubes thus visualising how different types of sustainability is weighted in the strategy.
- After the workshop the project manager inserts the conclusions from the dialogue process into the digital tool and the tool provides him/her with input for the tender material and a series of graphs of the project performance at this very early stage of the design process.
- After the project tender has been completed the prioritisation can be revised in collaboration with the residential democrats if they need to find areas to save money or if the winning tender has improved the project's sustainability.

4.   CONCLUSION

This paper presents the development and content of a tool developed for early actor involvement in decision making processes related to sustainable building design. The tool development was based on a combination of design thinking and gamification. The preliminary tool was tested in August 2016 with positive feedback and great suggestions for improvement by project managers in residential housing organisations. A second round of testing was completed with residential democrats and their project managers in November and December 2016. The feedback from this test was very positive and the work group got some interesting input on what was difficult to understand and ideas for how to improve the tool.

The conclusion of the prototype tests was that a) Using analogue elements such as dialogue cards and Centricubes in the dialogue with residential democrats increases their understanding of sustainability and their engagement in the decision-making process, b) Physical activity increases the actors' remembrance, c) Gamification is interesting because it makes actors reflect on how to improve the performance of their decisions towards the project's sustainability profile and d) the final tool needs to find a balance between abstract ideas and specific solutions that

ensures that the discussion does not focus too much on specific solutions and give an illustrative information over the prioritisation in the project exemplified in the numbers of coloured Centricubes referring to the 5 DGNB themes.

After the final testing in November and December 2016 the tool will be finalised. The final version of the tool is expected to be released in May 2016 and the final tool will be ready for presentation at the WSBE17 conference.

Design Thinking has proven itself as a valuable method for the tool development. Without the conscious and strategic use of open and closed modes the final tool would not have ended out as well as it did if the work group had designed it without the input from the advisory board and the test group.

ACKNOWLEDGEMENT

REFERENCES

[1]   Aumann, R. J. 1989, Game Theory, UK, 1st edition.
[2]   Brown, T. 2009. Change by Design, U.S.A, New York, 1st edition.
[3]   Danish Association of Architects [Online] Retrieved from https://www.arkitektforeningen.dk/konkurrence/fremtidens-baeredygtige-almene-bolig [Retrieved on Septemner 28, 2016]
[4]   Danish Green Building Council, an introduction to DGNB [Online] Retrieved from: http://dk-gbc.dk/publikationer/an-introduction-to-dgnb/ [Retrieved on September 27, 2016]
[5]   Designskolen Kolding, the design process model [online] Retrieved from: https://www.designskolenkolding.dk/en/design-process-model [Retrieved on September 20, 2016]
[6]   Hansen, H. T. R. and Knudstrup M., Parametric analysis as a methodical approach that facilitates the exploration of the creative space in low-energy and zeroenergy design projects [Online] Retrieved from http://architecture.ucd.ie/Paul/PLEA2008/content/papers/oral/PLEA_FinalPaper_ref_207.pdf [Retrieved on September 20, 2016]
[7]   IDEO, About IDEO [online] Retrieved from: https://www.ideo.com/about/#68W5xiugGsSb0m6I.99 [Retrieved on September 20, 2016]
[8]   John Cleese lecture, How to be creative [Online] Retrieved from: https://vimeo.com/89936101 [Retrieved on September 27, 2016]
[9]   Landsbyggefonden, om landsbyggefonden, organisation [Online] Retrieved from: https://www.lbf.dk/om-lbf/organisationen/ [Retrieved on September 20, 2016]
[10] Retsinformation, Bekendtgørelse af lov om almene boliger m.v. [online] Retrieved from: https://www.retsinformation.dk/forms/R0710.aspx?id=183636 [Retrieved on September 27 2016]

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