Sustainability and DIY as emerging factors for online service offers

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ABSTRACT

Purpose –

The paper showcases possible future online service offers in the context of DIY (Do-it-yourself) and sustainability. It explores the relationship between DIY practises and sustainability as well as how sustainable DIY approaches can reach a mainstream audience.

Design/Methodology/approach –

Given the prognosis on global consumption of natural resources, sustainability has become a significant concern in almost all sectors of human life. This is not a hindrance to the growth of various business models.

On the contrary: The necessary dispersion of sustainable approaches can be a substantial economic stimulus. An example is the DIY-trend (Do-It-Yourself) on media platforms. It illustrates the space and potential for new platforms and business models. It also integrates the mega trend of individualization.

The paper, therefore, analyses Sustainability and DIY as emerging factors for online services in three steps:

1. It starts by reviewing existing examples of online platforms and business models that are already established, in the context of DIY and sustainability.
2. It identifies areas of the field which are not yet or are only partially covered by service offers, but clearly, show demand for them.
3. Based on these examples, potential future developments and limits of future approaches are outlined.

As for the methodological approach, the paper uses a case study based on qualitative content analysis, media and references to scientists in the field. The upsurge of sustainable concepts in the private sectors covers many areas which will appeal toward a mainstream consumer base.

Findings –

In conclusion, the paper summarizes key features in possible online service offers, which foster more sustainable consumer behaviour through DIY projects. It gives an overview, of the parameters of which could be altered, to adjust the offers to different target groups.

Therefore, a blueprint for future service offers in the field of sustainability through DIY projects, is created.

Research limitations/implications (if applicable) –

Practical implications (if applicable) –
The paper delivers analysis that could be useful for developing new online business models.

Originality/value –
The paper focusses on possible online service offers for DIY consumers who want to create a sustainable impact.

Key words (max 5)
Do-it-yourself (DIY), Consumer behaviour, Sustainability, Online Service Offers, Maker culture

Paper type – Research paper

Preface

Given the prognosis on global consumption of natural resources, sustainability has become a significant concern in almost all sectors of human life. The solution requires a broad approach to sustainability, which will cover areas such as; politics, education, consumer society, media platforms and social networks. This is not a hindrance to the growth of various business models.
The definition of “sustainability” as used in this paper is derived from the concept of “sustainable development” as mentioned in the paper “Our Common Future” from the Brundtland Commission from 1983, which is an approach that “… meets the needs of the present without compromising the ability of future generations to meet their own needs.” (World Commission on Environment and Development 1987).
The consumer of industrial countries has an enormous power when it comes to establishing sustainable approaches and standards. While there are citizens which are forced to make buying decisions mainly based on economic reasons, most of the citizens are free to choose sustainable options and therefore determine the development of the whole market. Based on this thought labelling products as eco-friendly, fair trade or organic etc. has developed to a crucial mechanism in navigating consumers towards sustainable buying decisions. However, due to the growing diversification of information about sustainable ways to create products or services labels are no longer the only way to determine a sustainable consumption decision. Examples are Social Media, video platforms like YouTube or internet platforms.
DIY (Do-it-yourself) as a concept, that is defined by laity crafting and producing various products and objects, is established since decades. Its crucial quality is the

externalization of production costs. Work is carried out without loan and therefore the main costs are only tools and material. DIY “products” are not generally more sustainable as products coming from other production methods. However, DIY products can be a perfect vehicle for sustainable approaches. Firstly, they can be made from recycled material and secondly, through the acquired production knowledge by the creator they are easier to repair or to repair at all, compared to bought products. There are also secondary aspects to the sustainability of DIY creations. One example is that higher quality materials can be used, or additional production steps can be added to make the creations more durable. Adjusting the products towards the user is also an option.

Motivation

There are various ways to use online resources for own DIY projects. To showcase how DIY builders can benefit from current online service offers and how they could be improved a practical example will be used. Offered features and information will be analysed and compared. They will be combined with information and features from other internet resources which are not particularly addressing DIY builders.

The concept of DIY blueprints

Essentially there are two ways to create a DIY object. The one is to build it from scratch, which also includes the conceptual design of the object. Another way is to build a DIY project following instructions. There are also hybrid forms which include aspects of both options.
DIY blueprints can come in various formats. It could be an only graphic format but also various types of files.

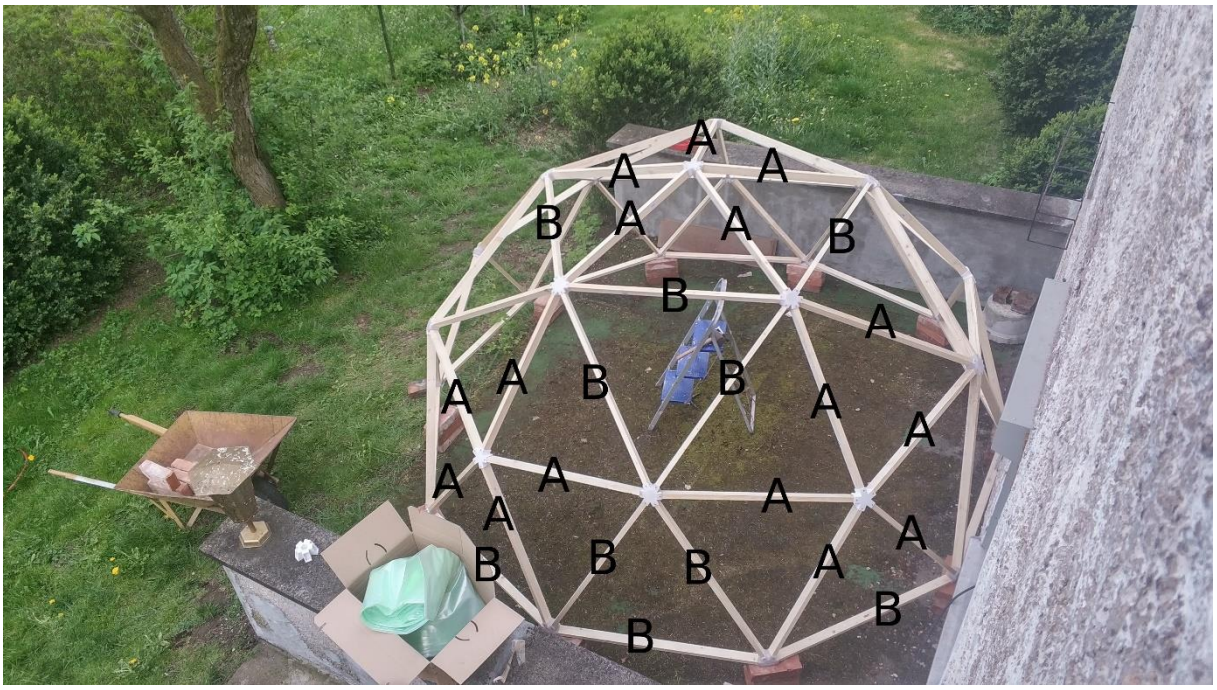
A geodesic greenhouse as practical example and case study

A main field of consumer based approaches towards sustainability is gardening. Therefore, as a practical example the building process of a geodesic greenhouse will be used. For composition 3D printed parts, material from hardware store and a gardening shop as well as common tools are used.
Geodesic designs, as a dome structure divided into triangles, do have a historic background and various benefits as well. The static properties of a geodesic design are better compared to classic approaches like a double pitch roof. Also it has an excellent ratio between surface area and volume. There is far less surface area compared to the volume. Moreover, the material necessary to build a certain amount usable floor are being less compared to other solutions (Mansfield 2016). All these properties make it quite suited for a DIY project on the one hand. On the other hand, there are aspects which are quite difficult to build for layman. The amount of different angles which are necessary to build a geodesic dome from parts of timber is enormous since the construction is quite complex compared to a double pitched roof. At this point the introduction of new technologies, like 3D printing, into the end consumer market is a great advantage for DIY projects. The problem of cutting the timber in complex angles at the ends can be solved by using 3D printed parts to connect the timber at these ends. This connection parts are called “hubs”.

By using 3d printed hubs to create the main structure of the DIY geodesic greenhouse the main problem of the creation process is solved. All other steps can be realized by classic approaches like cutting wood in straight angles and screwing parts together.

Building of the greenhouse prototype

As practical part of the research a geodesic greenhouse prototype is build. As construction method a set of 36 3D-printed hubs which connects 65 timber parts is used. As source for the printed hubs the site “www,thingiverse.com” is used. Specifically, the design “2V Geodesic Dome Connectors for 1x2 lumber” from Tara Flannery (Flannery 2017). To create a realistic scenario a low budget 3D printer is selected. Therefore, the parts will be produced by an Anycubic i3 Mega, which is based on the commonly known PRUSA i3 and produced by chinese manufacturer Anycubic. As material PETG (Polyethylenterephthalat) is used. It is often made from recycled PET-Bottles and its benefits will be discussed in detail. As source of information about the materials different online resources not linked to thingiverse were used. General knowledge about this topic can be acquired by google search or Wikipedia, since more scientific sources do not fit the target group of laity. Examples are 3dprintingforum.org, or 3dprintboard.com as well as other internet forums and boards related to 3D printing. While PETG is obviously easier to print as other materials like ABS (Acrylnitril-Butadien-Styrol-Copolymer) it requires some skill to master the material (Simplify3D 2019). Typical issues are oozing (unwanted material strings in the part), warping (deformation of the part due to the use of to less material or wrong temperatures) and clogging of the 3D printer nozzle (the material itself produces a residue which accumulates at the nozzle). Another topic is the printing time. FDM printers (Fused Deposition Modeling) are limited in printing speed. Additionally, PETG demands slower printing to produce flawless prints. Therefore, to print one hub to connect timber in the dimensions 2,4cm to 4,8cm around 16 to 18 hours are required (depending on if a 4, 5 or 6 way connector is printed). Including complications, reprints and maintenance of the 3D printer nearly 2 months are needed to print the hubs for one geodesic greenhouse. However, the time which is needed for active work on the greenhouse is far less, since the print works automatically and only the starting phase of a print requires much attention. Most failures and problems occur in the starting phase of a print (like failure in bed adhesion of the print).
When it comes to the timber elements, hardware stores often offer to cut timber already at the desired length. Since a geodesic dome with 36 hubs requires only 2 lengths of timber (strut length A and B as shown in the picture B1), cutting is relatively easy and economic. In the practical example 36 timber sticks with the dimensions 200x48x24 mm were bought. All timber were cut at 94cm. The result were the required two lengths of 94cm (strut length A) and 106cm (strut length B). As connection between timber and hubs small stainless steel screws were used. As surface coverage for the dome a UV4 greenhouse foil was used. UV4 means that the product should last at least 4 vegetation periods. As entrance for the greenhouse the timber of one pentagon of the dome were removed (see picture B2). The foil was fixed with clinches. To hold the foil on the ground at the edges of the dome repurposed bricks were used. The dome was placed on a flat surface. For all works except the printing of the hubs only one day was necessary.



B1: Geodesic greenhouse made from 3D printed hubs and timber. (with strut A&B)

B2: Struts removed for entrance and UV4 greenhouse foil added.

Three criteria for benchmarking sustainability in DIY blueprints

The need for a transparent benchmarking system for DIY projects is immanent, since there is an active discourse about the topic of “greenwashing” which is to use different methods to make a product look sustainable or ecological whilst it isn’t (Becker-Olsen, K. and Potucek, S. 2019). While there is the possibility to convince the consumer of the sustainable quality of a non-sustainable product, focussing on such an approach wouldn’t be sustainable itself for any business model or product. That is because it would mean to base your product strategy on an asymmetry of information between seller or producer and consumer. This would imply that the seller or producer is aware of the lack of sustainability of its product. The even worse scenario would be if there is not even an awareness of the lack of sustainability but just the aim to make a product look sustainable. Current online resources for DIY knowledge and blueprints do not feature any form of benchmark of the sustainability level of the certain DIY projects.

Focussing on the definition of sustainable development three exemplary criteria for judging the grade of sustainability in a DIY product can be introduced. These are Customizability, Durability and the Material (based approach).
Customizability describes in which degree the DIY project can be altered. Possible alterations are the scalability and the option to use only needed parts and spare out unrequired parts. There can also be different versions of parts from which are only the needed ones are to be realized. This criterium benefits sustainability in mainly two ways. It reduces the required building material to a minimum and it also ensures that the product is fitted as much as possible to its user. Adjusting the project towards the user minimizes the risk of the need to replace the finished project by another one or a bought product. It also tends to make required repairs easier for the builder.
Applied to the example of the geodesic greenhouse customizability manifests in various ways. The size of the greenhouse can be freely scaled by shortening or lengthening the timber to the required sizes. In the chosen complexity of the dome only two different lengths of timber are required. There are free online tools available for the calculation of the lengths suited for different complexity levels of geodesic domes (Domerama 2012). Besides the scalability of the whole construction the strength of the timber can also be adjusted. Therefore, the 3D printed parts can be altered to fit different sizes of timber. The aspect of sparing unnecessary parts can also be seen in the example. To make an entrance a pentagonal part of the construction can be spared out (see picture B2). Also the customizability of a DIY geodesic greenhouse goes beyond scaling. Various materials can be used, which shall be discussed in the following.
The **Durability** of a DIY project is the determined by its overall construction blueprint as well as by the choice of material and additional postprocessing like varnishing. The choice of **material** itself is another benchmarking criterion, since it is possible to use recycled material or repurpose whole other objects or parts of them.
Applied to the example of a self-build geodesic greenhouse the durability is mainly determined by the geodesic design and the selection of material. A dome construction is a sturdy design. The strength against physical stress is high. The small surface compared to the volume and the round shape makes it less vulnerable towards wind. Based on this physical assumption the construction itself should last long against physical stress. (Mansfield 2016) When it comes to chemical influences and solar radiation the durability is mainly determined by the selection and post processing of the used materials. The 3D printed parts need to be flexible and strong at the same time. From the available printing materials PETG (Polyethylene Terephthalate) is used

for various reasons. The main arguments are its physical and chemical qualities. The shock resistance and physical strength is good. At the same time, it is easier and at a lower temperature to print as other plastics like ABS (Acrylonitrile butadiene styrene) plastic. It also shows a quite high resistance against solar radiation for a plastic (Simplify3D 2019). The durability of the 3D printed hubs can also crucially be improved by post processing. For example, one or more layers of varnish could be added to the hubs to make it more lasting against ultraviolet radiation. The selection of the timber is also a decision between properties of different wood types as well as a question of sustainability. Using regional softwood / pinewood is a good solution for the project.
As the example shows, there are plenty ways to make the DIY geodesic greenhouse more durable and therefore more sustainable. However, none of them is mentioned on the internet platform where the print files of the hubs come from. So for making this DIY project more sustainable the consumer has to research and investigate on his own, even adding this information to the source side (Thingiverse.com) would make sense.

Existing online approaches towards sustainability and DIY

There are various sites around that offer access to blueprints in general for DIY projects. Also due to the larger availability of machines like 3D printers or laser cutters for end consumers, there are many offers for 3D models and files for laser cutters around. Both free as for payment as well.
Online Platforms which offer blueprints and files have also different features to make the access easier and more interactive. An example for an easier access would be a detailed search function which offers different criteria. An example for a more interactive access would be adding “makes” to a certain blueprint on the website. A “make”, for example called so on Thingiverse, are for example uploaded pictures from a person who already printed out a 3D file or finished a DIY project. This option leads to certain benefits. DIY creators can estimate how their project may turn out for example. There are also websites which focus more on the DIY aspect itself, like buildsomething.com. However, they seldom integrate additional knowledge and new methods like 3D printing. Therefore, integrating resources would be the best possible way to improve these online service offers.

Blind spots in DIY offers

While there are various approaches towards offering DIY concepts to consumers, derived from the practical example of a geodesic greenhouse, the case study also shows the shortcomings of these platforms. They mainly focus on offering one specific part of the project like construction plans or files for 3D printers or laser cutters. Still bringing an DIY project successfully to live far more then constructions plans etc. is necessary. This is especially the case when sustainability shall play a major role. While there could be argued that DIY builders have a certain amount of experience in constructing things and using or post processing different materials, a possible aim would be to bring DIY projects in the context of sustainability in the focus of a mainstream audience. To serve this aim different strategies could be used. The internet as media offers a lot of different tools to do so. Bringing together needed information in an easily accessible way is a main criterion. To solve this task, three possible features that could be included in existing and future online platforms shall be

introduced. They are derived from the information needs and experiences of the practical example of a DIY geodesic greenhouse.

(All-in-One) DIY blueprints as product concept

A missing link in platforms that offer DIY blueprints and files is an all-embracing connection to other resources related to the project or topic. DIY blueprints or files can be linked to resources which offer a broader access to the certain project or topic. An example would be 3D printed parts which shall be combined with other materials. Helpful information about this combination and the material itself could be added. This includes the post processing of materials as well.
As the example of the geodesic greenhouse shows, a lot of research had to be done to make the DIY project a more sustainable concept. The scope, in terms of size, of the required information itself would be easily to integrate into the platform. Additional information intertwined with the blueprint and further features can add additional value to the online platform. The concept of an All-in-One DIY blueprint would represent an offer of information that could be charged.
Applied to the example of the DIY geodesic greenhouse information on various aspects of the project could be integrated. In the project the calculation of the length of the timber segments needed to be done on a website (Domerama 2012) different from the source of the 3D printing files of the hubs (Flannery 2017).

Benchmarking of sustainability level

A feature not integrated in online platforms which offer blueprints or files is a sustainability benchmark. Benchmarking the sustainability of a product or own build compared to other solutions could be realized in various forms. However, no approach towards this feature can be witnessed in current online platforms.
An approach based on the three benchmarking criteria introduced, customizability, durability and material could be useful. Also this catalogue of criteria could be extended. The Benchmarking could be realized in a peer-review mechanism for example.

Modularity and Connectivity between DIY projects / clusters

Besides the All-in-One DIY blueprints and the benchmarking of the sustainability level of DIY projects a third option would be to create DIY projects as a kind of modular collection. Therefore, a functional and aesthetical purpose could be implemented. A functional modularity could be manifested in splitting bigger projects in smaller sub-projects. An aesthetical purpose could be fitted by introducing various blueprints in the same style that fit together. An example could be a collection of DIY furniture.

Outlook: A future DIY online platform prototype

There are different findings which can be derived from the practical example of building a geodesic greenhouse prototype. Online platforms like Thingiverse offer already useful features for DIY builders (Flannery 2017). Features known from social networks like commenting, sharing, rating and linking are complemented by 3D print related features. Remixing is the option to alter a 3D blueprint and link it as variation to the source material. The level of customizability is raised through this mechanism. “Makes” are pictures, videos and descriptions from builders that already realized a DIY project. Future builders of a similar project can already orientate their plans according to this resources. Furthermore, registered users of Thingiverse have the option to collect different blueprints in lists which may or may not be visible to other users according to the selected properties of the list.

Thingiverse is centred around the idea of offering blueprints for 3D printers and laser cutters. A lot of useful and required information is not linked. Therefore, the builder needs to do a lot of extra research to gather all necessary information for the building process and the project itself, which is not hosted or linked on Thingiverse. Integrating further resources in a user friendly way would improve the overall usability of the site. At the current status further information could be added by comments. This option does not sort the information or ensures its usefulness. Adding a register or option for useful knowledge would be one option to improve the platform.

If it comes to a platform which should focus around DIY and sustainability as primary aspects, the proposed features should be integrated. All-in-One blueprints would intertwine further necessary information with the blueprint or project. A benchmark of the sustainability level could ensure the sustainable character of the project. It could even give hints how to improve the sustainability of the project by using different materials or post processing methods. Modularity of blueprints and projects could be introduced in two ways. First by subdividing larger projects in smaller projects. This would result in an easier and less frustrating workflow, because smaller tasks should be easier to handle. Also the blueprint would be more adaptable to the user if whole parts could be spared out. Secondly it could be modular in an aesthetic way. Different projects could fit together like furniture in the same style. One sustainable project could therefore lead to others.

All in all, the crucial step to make DIY and Sustainability go hand in hand is to integrate resources and information. Once the user has all required information and resources at hand or accessible in a few clicks, realizing own sustainable projects should become more likely possible.

References

1. Becker-Olsen, K. and Potucek, S. (2019): Greenwashing. [online] SpringerLink. Available at: https://link.springer.com/referenceworkentry/10.1007/978-3-642-28036-8_104 [Accessed 4 Feb. 2019].

2. Dabija, D. and Bejan, B. (2019): Green DIY store choice among socially responsible consumer generations. [online] SpringerLink. Available at: https://link.springer.com/article/10.1186/s40991-018-0037-0 [Accessed 1 Feb. 2019].

3. Domerama (2012): 2V Geodesic Dome Calculator [online] Domerama. Available at: http://www.domerama.com/calculators/2v-geodesic-dome-calculator/ [Accessed 1 Feb. 2019].

4. Flannery, Tara (2017): 2V Geodesic Dome Connectors for 1x2 lumber. [online] Thingiverse. Available at: https://www.thingiverse.com/thing:2483498 [Accessed 1 Feb. 2019].

5. Hopkins, J. (2019): DIY Spectroscopy. [online] SpringerLink. Available at: https://link.springer.com/chapter/10.1007/978-3-319-01442-5_4 [Accessed 1 Feb. 2019].

6. Mansfield, M. (2016): The Benefits of Geodesic Dome Greenhouses. [online] SpringerLink. Available at: https://www.maximumyield.com/the-benefits-of-geodesic-dome-greenhouses/2/2647 [Accessed 1 Feb. 2019].

7. Salvia, G. and Cooper, T. (2019): The Role of Design as a Catalyst for Sustainable DIY. [online] SpringerLink. Available at: https://link.springer.com/chapter/10.1007/978-3-319-29665-4_2 [Accessed 1 Feb. 2019].

8. Simplify3D (2019). Filament Properties Table. [online] SpringerLink. Available at: https://www.simplify3d.com/support/materials-guide/properties-table/ [Accessed 1 Feb. 2019].

9. World Commission on Environment and Development (1987): Our Common Future. Oxford University Press