DELIVERABLE 2.4.1
THE HYDROGEN UTILISATION BUSINESS MODEL

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Abstract:
The deliverable presents the results of activity AT 2.4 Creation of The Hydrogen Utilization Business (HUB) Model. The report starts with theoretical background of business model concept and tools and describes the dedicated tool for HUB model design available at project official website (https://huge-project.eu/hub-model/). The report also describes the application of the tool with the examples from project case studies.

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1. Introduction

The objective of the current report is to presents the results of project activity AT 2.4 Creation of The Hydrogen Utilization Business (HUB) Model. The activity capitalizes on results of previous tasks (AT 2.1, 2.2, 2.3) and results in generic HUB model based on traditional and well-known business model canvas by Alexander Osterwalder (2010) and emphasizes the specific elements of traditional business model which require adjustment in order to introduce novel hydrogen-based solutions. While the canvas does not provide the actual instruments for financial calculations (these instruments have been developed under activities of WP T1 Techno-economic assessment of viable technical processes for remote, peripherical and dispersed hydrogen operations in the public infrastructure domain and beyond) this tool is important for conceptual design and analysis of company business and better understanding of the components required for successful delivery of the value proposition.

The importance of business model for successful business design and value creation has been long acknowledged by both academics and business practitioners. In the following chapter we provide a brief outline of several major concepts and tools proposed for understanding of business models (BM). We place specific focus on business model innovation as that is commonly considered as a way to achieve competitive advantage, the way to come up with novel value proposition or methods for its delivery and appropriation. That is especially important in light of hydrogen utilisation, because (as it is also can be seen from project regional case studies – see DT 2.5.1) very often the question is not in building the completely new business from the scratch but rather in successful adoption of novel (in our case hydrogen-based) technological solutions by already existing companies who need to rethink and modify their current (and supposedly successful) business models in order to incorporate new technology and be prepared for further changes.

Next, we proceed with the description of the actual HUB model tool developed (https://huge-project.eu/hub-model/). We start with general overview, discuss the developed canvases (similarly to Ecosystem mapping tool described in DT 2.3.1 we created online-based canvas and downloadable template) and finalise with elements components of business model which need to be taken into account for successful hydrogen utilisation. We complement the discussion with specific examples from project regional case studies and provide suggestions for organizing collaborative workshop on HUB model design. In the conclusion we discuss practical applicability of the developed tool and its synergy with other project outputs.

2. Conceptual overview

Firms create value through a variety of factors such as unique resources, innovation, and networks (Barney, 1991; Gulati et. al., 2000). Many scholars debate on what drives value creation, capture, and delivery while improving firm performance. In this regard, business model (BM) has been introduced as the firm's plan and strategy to recombine performance into systems of interrelated design factors (Massa, et al., 2017). In other words, a firm can create, capture, and deliver value to customers through its BM by considering the key four design themes of BM: novelty, efficiency, lock-in, and

complementarity. These themes are defined as "any factor that enhances the total value created by an (e-) business" (Amit & Zott, 2001 p.494). Novelty is considered as the primary driver in firm performance which is related to the introduction of novel combinations of products and services, creative methods in generating revenue, and novel ways to connect ecosystem actors such as supply chain actors, customers and other partners (Zott & Amit, 2007, 2008).

The literature on BM innovation is emerging the centre of focus on how firms can achieve new ideas, novel technologies, and innovative ways to deliver products and services through redesign of BMs (Bock & George, 2018; Hampel, et al., 2020; Shepherd et al., 2021). According to the impacts of BM innovation on firm performance, Leppänen et al., (2021) distinguish novelty as the core theme that enables BM innovation design in an organization. A firm's BM describes the sets of interconnected selections and mechanisms through which it creates and delivers value for the stakeholders and at the same time captures value for itself (Teece, 2010; Snihur et al., 2021). In addition to enhancing firm performance, BM innovation creates significant sources of competitive advantage (Casadesus- Desyllas and Sako, 2013).

Osterwalder et al., (2010) created BM canvas tool for a holistic understanding of BM in a structured way. Utilizing this canvas provides insights about firms customers, and what are the value propositions, through which channels these values are offered, and how company makes revenue. Firms can use BMs to understand their BM or their competitor. BM canvas is a shared language between a group of people who are brainstorming to have visualization, description, assessment, and occasionally change the existing BM.

3. HUB model

The tool provides generic template outlining the specific elements of traditional business model which require adjustment in order to introduce novel hydrogen-based solutions. The tool capitalizes on the results of stakeholders and value analysis and ecosystem mapping exercise (see respective reports DT 2.1.1, DT 2.2.1 and DT 2.3.1). It is therefore advised to use the tool in conjunction with ecosystem mapping tool (described in DT 2.3.1), although both tools can be used independently reflecting the specific objectives of the user and available information.

The tool is available at the project official website (https://huge-project.eu/hub-model/). The tool page contains the brief information about the business model, the description of main elements of the tool and the links to downloadable business model canvas (in pdf format) and online tool (located at Miro boards services). Depending on their preferences and technical capabilities the users can utilize either online template or use printed canvas for f2f workshops. The page also contains the links to supporting materials (including the following report) where the steps for data collection and preparation as well as the tool application and illustrative examples from project regional case studies are presented in greater details. The screenshot of the tool page is presented below (Figure 1).

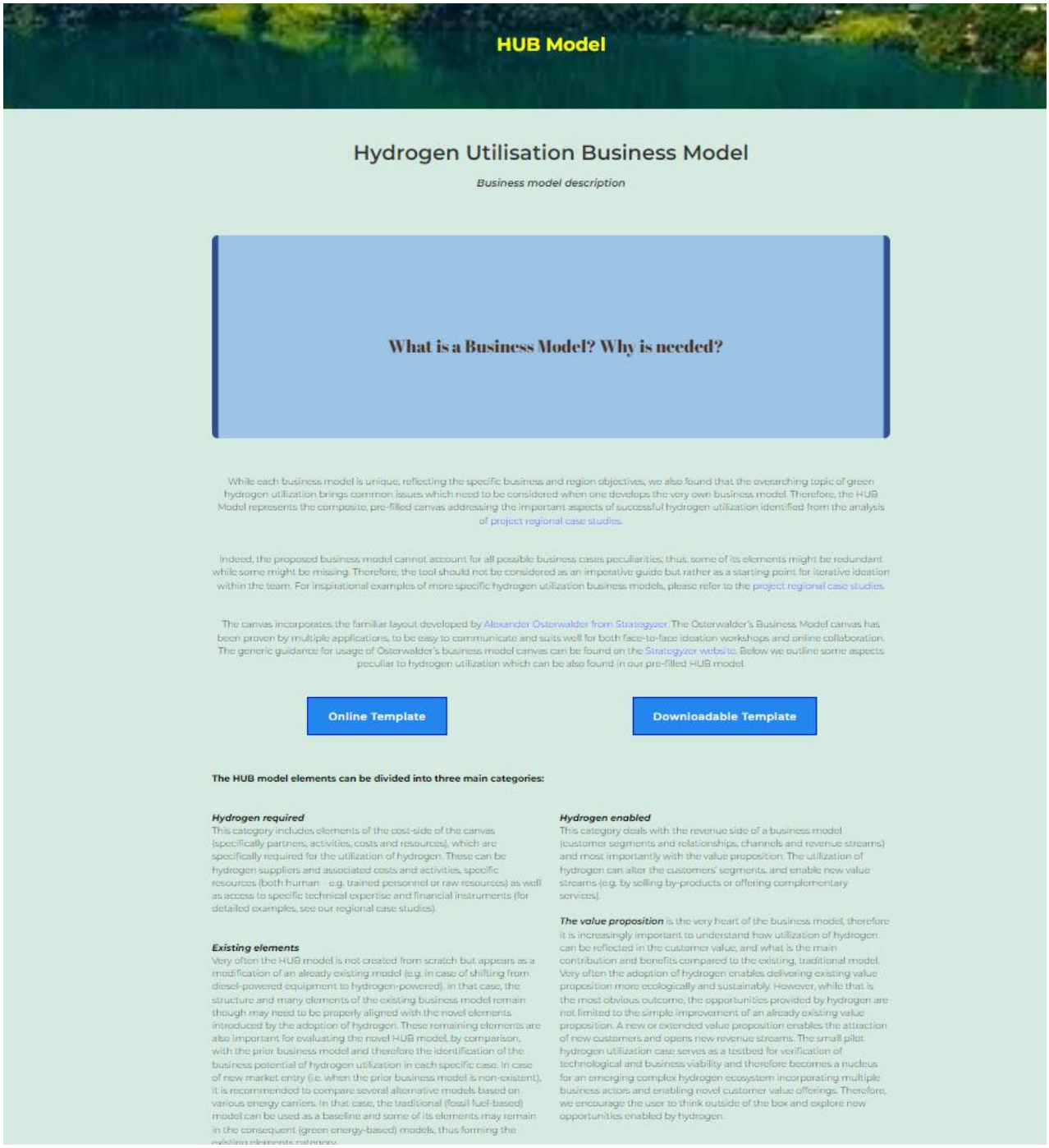

Figure 1. The HUB model online page

3.1. Templates

The tool is available in two formats: downloadable pdf template for printing (Figure 2) and online template (Figure 3). The downloadable pdf template presents a simple canvas with dedicated areas within common Osterwalder's business model component (for description of these areas the following part). The canvas can be printed (preferably on a large format such as A2-A1) and used during the f2f brainstorm sessions. The ideas to specific elements of BM can be simply written on the canvas or sticky notes can be used. The approach is intuitive and easy to implement and does not require any specific online collaboration expertise and tools, however the modification of once drawn

business model is difficult (ideally a new template needed) and opportunities for co-design with remote participants are limited.

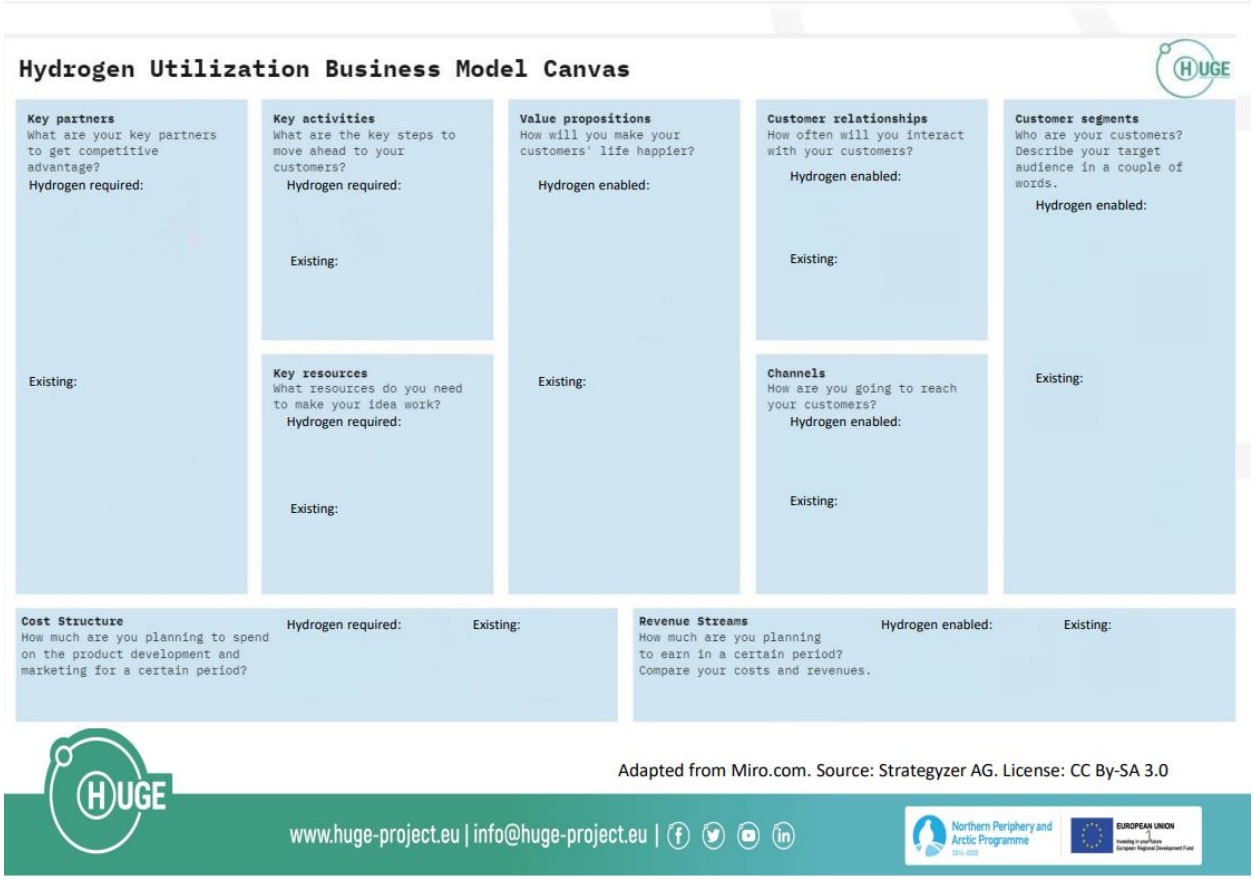

Figure 2. Downloadable HUB model canvas

To overcome the limitation of simple printed ecosystem map the online canvas can be used. The canvas is implemented through Miro boards (https://miro.com/) a whiteboarding platform enabling online communication and co-development. With the use of online Miro canvas, the distantly located users can simultaneously work on the HUB model which can be further shared with other stakeholders. Additionally online tools allow for greater flexibility and modification in the created models which facilitates the design process even further. Consequently, the online template differs from the downloadable canvas by greater details and complementary information (since these additional details can be easily removed or changed depending on specific user objectives). Similarly, to downloadable template users can add their ideas by typing and adding virtual sticky notes to the canvas elements. For better clarity it is advisable to use structured color scheme assigning specific colors to specific elements. Users can stick with the suggested color codes or create the custom scheme using standard Miro tools.

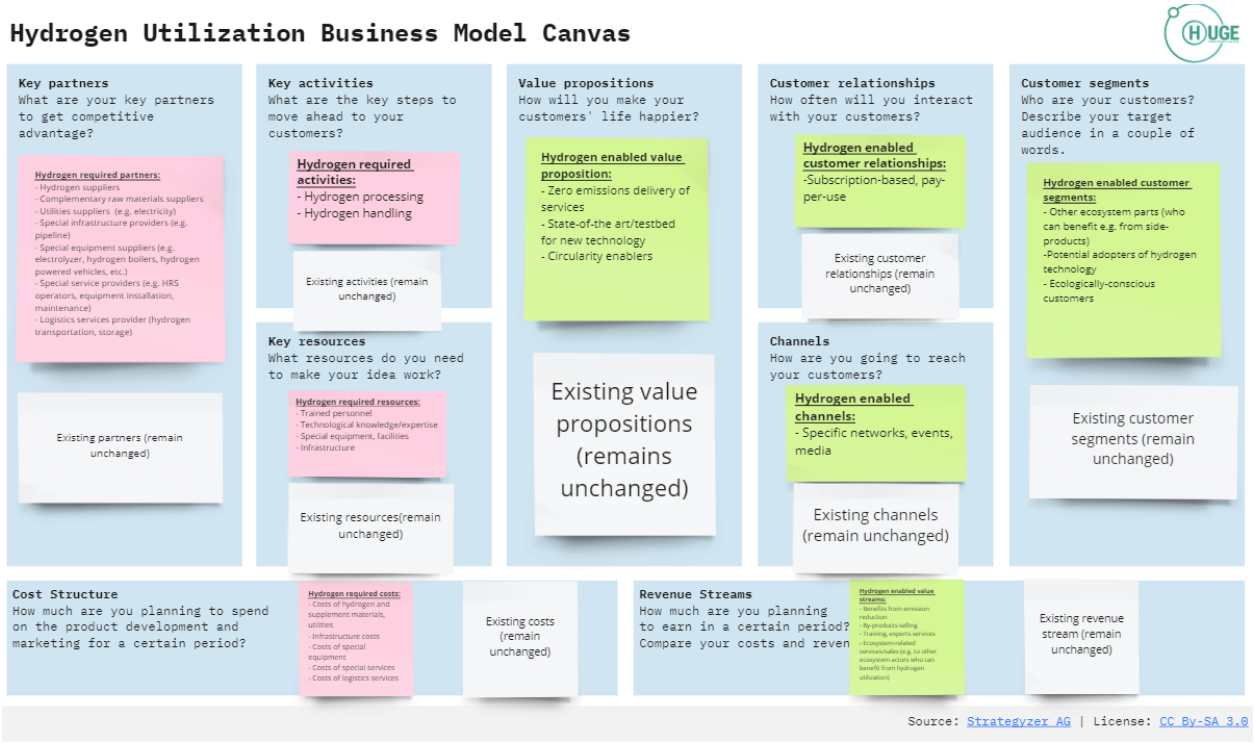

Figure 3. Online HUB model canvas

The provided templates allow various approaches for business model design and analysis both online and offline, individual and collaborative. It should be noted, however, that online template, due to its nature (allowing for easy modification) provides more information comparing to pdf downloadable template. Therefore, it is advisable even for pdf canvas users to get acquainted with the online template in order to get better understanding of ecosystem structure.

3.2. HUB elements

The proposed canvas incorporates the familiar layout developed by Alexander Osterwalder from Strategyzer (2010). The Osterwalder's Business Model canvas has been proven by multiple applications, to be easy to communicate and suits well for both face-to-face ideation workshops and online collaboration. While each business model is unique, reflecting the specific business and region objectives, we also found that the overarching topic of green hydrogen utilization brings common issues which need to be considered when one develops the very own business model. Therefore, the HUB model represents the composite, pre-filled canvas addressing the important aspects of successful hydrogen utilization identified from the analysis of project regional case studies. Below are listed the generic elements of business model:

- Customer segments: List the top segments which provide the highest revenue.
- Value proposition: What are the products/services you offer to the customers? What is the value you offer to the customers?
- Revenue streams: List the highest revenue streams, also the things you offer for free.
- Channels: The ways you communicate with the customers. The way you deliver value proposition.

- Customer relationships: How does the relationship look in the canvas and what is your plan to maintain it?
- Key activities: What is your everyday activities to run the BM?
- Key resources: The people, knowledge, means, and money you need to run your business.
- Key partners: List the partners that you can't do business without (not suppliers).
- Cost structure: List your top costs by looking at activities and resources.

To systematize the design of business model and specifically to address aspects of hydrogen utilisation (comparing to generic Osterwalder's canvas) we added to the standard canvas elements further classification on Hydrogen required (relates to the cost side of business model including such elements as partners, activities, resources and associated costs) and Hydrogen enabled (relates to the revenue side of business model including such elements as customers segments, relationships, channels and revenue streams). The specific focus should be placed also on value proposition in order to identify the specific value which utilisation of hydrogen can bring to existing offerings as well as account for opportunities of creating new offerings. Finally, the remaining, unchanged components can be summarized in Existing category and relates to all components of business model. In the following we discuss these categories in greater details with specific examples from the project regional case studies. We discuss value proposition separately as it is the very heart of the Osterwalder's business model canvas and therefore should be considered with great attention.

Hydrogen required

This category includes elements of cost-side of the canvas (specifically partners, activities, resources and associated costs) which are specifically required for utilization of hydrogen and delivering the novel value proposition. The partners can be for example hydrogen suppliers or HRS operators as in case studies focusing on transportation (Iceland, Faroe, and Aran Islands). Special equipment providers can also be considered as hydrogen-required partners. Similarly, companies ensuring maintenance and service of this equipment.

Finnish cases study provides example of specific activities concerned with hydrogen utilization and related to production and selling the synthetic fuel. In Scotland case study in addition to basic activities (concerned with the provision of education) the focal actor needs to take measures to ensure the safe usage of the equipment. The safety measures are important in all cases, however the focus on residential solutions makes them especially critical.

Specific resources include indeed hydrogen as fuel or raw material for further processing and special equipment as well as trained staff. For example, the successful realization of Icelandic case focusing on hydrogen trucks would require the trucks and hydrogen as fuel as well as trained personnel responsive for their routine maintenance (major repairs are accomplished by the dealer, but even small works might require special training due to safety issues associated with hydrogen).

Finally, the costs will account for all these new partners, resources and activities caused by utilization of hydrogen. The most common cost is the cost of hydrogen which may vary significantly depending on the source. Thus, in Finnish case, they hydrogen used – is an excess of production of local chemical company which otherwise released in the atmosphere. That allows for relatively modest costs of the raw materials although put certain limitations for scaling up the solutions and

replication it in other regions (since the cost of dedicated hydrogen production is higher). Several cases (such as Faroe and Aran Islands) assume availability of curtailed electricity coming from windfarms at lower price which decrease the price of hydrogen to the level competitive with the price of diesel. Nevertheless, the specific costs should be very carefully considered with respect to specific region opportunities and peculiarities.

Hydrogen enabled

This category deals with revenue side of business model (customer segments and relationship, channels and revenue streams) and most importantly with the value proposition. The utilization of hydrogen can alter the customers segments and enable new value streams (e.g. by selling by-products or offering complementary services). In some cases (e.g. Faroe and Aran Islands) the customers of by-products are not the actual customers for the focal company, however they add the utility to the whole ecosystem enabling more efficient hydrogen production and thus contributing to lower costs and higher circularity of the system.

In respect to customer relationships and communication channels our regional case studies did not reveal any specific changes, however it can be proposed that changing cost structure (costs are likely to increase in many cases) may force focus companies to offer alternative approaches for value capturing (e.g. subscription models, pay-per-use, etc.) and enhance the communication efforts in order to make customers aware about the sustainability benefits of new offerings. That might be especially pronounced in cases where the original business model and value proposition remain to great extent unchanged (such as e.g. in Iceland) and the costs (of equipment, fuel) at the early stages are high (before the holistic hydrogen based ecosystem including the high variety of players and customers for by-products is built). Thus, the companies need to place specific efforts to ensure that their offerings are competitive.

The associated revenue streams include revenues for the services and/or products offered but also can take into account various benefits coming from emission reduction. The actual nature of these benefits depends heavily on the specific case objective and region/country legislation and may include e.g. some tax incentives (e.g. in Iceland) or governmental subsidies (e.g. Scotland).

Value proposition

The value proposition is the very heart of the business model; therefore it is increasingly important to understand how utilization of hydrogen can be reflected in the customer value, what is the main contribution and benefits comparing to existing, traditional model. Very often the adoption of hydrogen enables delivering existing value proposition in the more ecological and sustainable manner (such as in Iceland, Scotland, Faroe and Aran Islands cases). However, while that is the most obvious outcome, the opportunities provided by hydrogen are not limited to simple improving of already existing value proposition. New or extended value proposition enables attraction of new customers and opens new revenue streams. For example Finnish case focused on production of synthetic fuel brings new opportunities for energy companies (direct customers) to reduce the usage of fossil fuel and eventually to decrease the overall system emissions. The small pilot hydrogen utilization case serve as a testbed for verification technological and business viability and therefore become a nucleus for emerging complex hydrogen ecosystem incorporating multiple business actors and enabling novel

customer value offerings (e.g. in Scotland). Therefore, we encourage the user to think outside of the box and explore new opportunities enabled by hydrogen.

Existing elements

Very often the HUB model is not created from scratch but appears as a modification of already existing model (e.g. in Iceland case of shifting from diesel powered equipment to hydrogen powered). In that case the structure and many elements of existing business model remain though may need to be properly aligned with the novel elements introduced by the adoption of hydrogen. For example in case of Aran Islands the harbor serves as an existing (traditional) partner for ferry operators but it can also be a customer for hydrogen producer thus being a part of the emerging hydrogen ecosystem.

These remaining elements are also important for evaluating of the novel HUB model, by comparison its with the prior business model and therefore the identification of business potential of hydrogen utilization in each specific case (e.g. to understand how many elements of cost/revenue sides changed/remained unchanged). In case of new market entry (i.e. when the prior business model is non-existent) it is recommended to compare several alternative models based on various energy carriers. In that case, the traditional (fossil fuel-based) model can be used as a baseline and some of its elements may remain in the consequent (green energy-based) models, thus forming the existing elements category.

3.3. Business model design workshop

In this chapter we provide some recommendations for organizing f2f workshop to design Business Model. The suggested preparatory activities including the mapping and analysis of ecosystem are described in prior deliverables (DT 2.1.1, DT 2.2.1, DT 2.3.1). The recommendations are adopted from https://www.businessmodelsinc.com/about-bmi/tools/business-model-canvas .The recommendations are generic and therefore for HUB model design the above discussed categories should be taken into account particularly during steps 4 – 7 of the following instructions.

1. Prepare a team of 3-5 people
2. Make a large space either on the round table or on the wall
3. Print the BM canvas in A3 or larger (A2-A1 if possible)
4. Use plenty of sticky note and markers for generating idea
5. Spend 45-60 minutes (each person can first think individually and then put their idea on the sticky note on the sheets)
6. Start first with vital aspects of the BM, the most important criteria and try to make clear criteria
7. Connect the building blocks: for each value proposition there should be a customer segment and a revenue stream.
8. Take an assessment of the whole canvas and rank the performance of the BM (bad-excellent, 0-10). You can use following questions:
    - How much does switching costs prevent your customers from churning?
    - How scalable is your business model?

- Does your business model produce recurring revenues?
- Do you earn before you spend?
- How much of the work can be done by others?
- Does your business model provide built-in protection from competition?
- On what cost structure is your business model based?

9. Final step is to have an artist visualization of the BM. It creates efficient way of sharing the model with others and easier visualization.

4. Conclusion

The report presents the results of activity AT 2.4 Creation of The Hydrogen Utilization Business (HUB) Model. The activity capitalises on the results of the prior activities and project regional case studies summarized in the form of generic HUB model canvas. In particular, HUB accounts for the necessary adaptation and configuration of existing and new products and services to the ecosystem. The report outlines the features of HUB model which differentiate it from the traditional Osterwalder's business model canvas and illustrates with the examples from the project regional case studies.

The tool is complementary to other project tools and specifically to techno-economic analysis (TEA) tool developed in WP T1. The synergy reveals in that that while TEA tool provides the means for estimation of the scalability potential and evaluation of the expected cash flow the HUB model in conjunction with prior Ecosystem mapping tool and associated analysis methodology provides the means for conceptual design and analysis of ecosystem and business model for the companies operating in such environment. The tools therefore should be used together in iterative manner, thus evaluating the preliminary design of business model from the techno-economic perspective and adjusting the model when necessary.

References

Barney, J. B. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17, pp 99-120.

Bock, A. J., & George, G. 2018. *The Business Model Book: Design, build and adapt business models that drive business growth*. Pearson: NY.

Gulati, R., Nohria, N., & Zaheer, A. 2000. Strategic networks. *Strategic Management Journal*, 21, pp 203-215.

Hampel, C., Tracey, P., & Weber, K. 2020. The art of the pivot: How new ventures manage identification relationships with stakeholders as they change direction. *Academy of Management Journal*, 63, pp 440-471.

Leppänen, P., George, G. & Alexy. O. 2021. When do novel business models lead to high performance? A configurational approach to value drivers, competitive strategy, and firm environment *Academy of Management Journal*, DOI: 10.5465/amj.2020.0969.

Massa, L., Tucci, C., & Afuah, A. 2017. A critical assessment of business model research. *Academy of Management Annals*, 11, pp 73-104.

Osterwalder, A., Pingeur Y., Clark, T., (2010) *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*, pp 10-51

Snihur, Y., Zott, C., & Amit, R. 2021. Managing the value appropriation dilemma in business model innovation. *Strategy Science*, 6, pp 22-38.

Shepherd, D. A., Seyb, S. K., & George, G. 2021. Grounding business models: Cognition, boundary objects, and business model change. *Academy of Management Review*, DOI: 10.5465/amr.2020.0173.

Teece, D. J. 2010. Business models, business strategy and innovation. *Long Range Planning*, 45, pp 172-194.

Zott, C., & Amit, R. 2007. Business model design and the performance of entrepreneurial firms. *Organization Science*, 18, pp181-199.

Zott, C., & Amit, R. 2008. The fit between product market strategy and business model: Implications for firm performance. *Strategic Management Journal*, 29, pp 1-26.