Analysing the Impact of the Implementation of a Blockchain in an Existing Business Model

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Abstract— **Blockchain technology offers great potential for companies and the number of start-ups whose business models are based on this technology is growing rapidly. However, for many companies already active in their respective markets, the question arises as to whether and how this technology is relevant to their individual business model and what effects an implementation in the company or in the corporate environment would have. These questions can be answered with the help and modification of existing methods and tools. In this paper, we present the method of business model stresstesting, which, with certain adjustments, can help to answer the question of the impact of Blockchain technology on an existing business model. This will help to actively shape and evolve the ecosystem emerging in the area of Blockchain technology. The implementation and further development of the technology based on specific requirements from the business environment is thus facilitated and accelerated.**

Keywords: Blockchain; business model; stresstesting; stressfactor.

I. INTRODUCTION

Companies are typically faced with uncertainties regarding their future environment and their development [1]. In this context, the further development of business models is considered to be of great importance for maintaining competitiveness and economic growth [2]. The redesign of business models with the inclusion of innovations should lead to an increase in the robustness of a business model with respect to uncertainties in the company's environment [1]. Such business model innovations can be defined as systemic changes in the economic and entrepreneurial logic of companies in creating and maintaining value for both customers and companies [3]. Such changes also include modifications of value creation stages and the integration or elimination of partners in the value chain [4]. New technologies are among the external drivers of business model innovation [5]. For example, by creating new technologies or using existing ones, a company's existing resources can be better utilized, and a competitive advantage can be generated [3][5]. One technology in this context is the Blockchain technology [5]. The future effects of implementing this technology are not yet fully foreseeable for companies [6].

Analytical approaches to researching business model innovations deal with how business model components are influenced by the introduction of new technologies [6]. According to Nowiński and Kozma, examples of such analyses can already be found, for 3D printing, life science innovations and cloud technology [6]-[9]. Nowiński and Kozma have already been striving to develop methods to assess the impact of the implementation of Blockchain technology in existing business models [6]. The goal of this paper, as part of a project on evolving ecosystems and services, is to complement this approach with a concrete method to create opportunities for actively building the ecosystem around the Blockchain technology and to support the further evolution of the technology against the background of existing business models. This enables future integration of the Blockchain technology into existing business models, making business processes smoother and more secure.

The second section of this paper first introduces the method of stresstesting for business models in general. In the following third section, the procedure of this method is presented and modified for the concrete application to evaluate business models against the background of the Blockchain technology. In the fourth section a summary and an outlook are given.

II. STRESSTESTS FOR FUTURE BUSINESS MODELS

Technology forecasting provides an overview of existing and emerging technologies and how they influence and replace each other [10][11]. Technology forecasting thus shows developments that begin in the past. As shown in Figure 1, scenario planning begins where technology forecasting stops. To a certain extent, the early detection of scenario planning can provide a range of possible developments [10]. Scenarios represent outlooks on the future, describing how it could develop based on clearly defined assumptions [10]. By presenting possible technical implementations in scenarios, technologies can be brought closer to future users and thus appear more real. Scenarios thus make it easier for decision makers to include future technologies in the decision-making process [10]. They make it possible to better assess the risks of decisions under high uncertainty. Scenario planning recognizes that the future environment of a company is uncertain. This

approach helps to assess the robustness of a company against the background of possible scenarios [1]. Scenario planning thus creates a basis for decision-making and, similar to the explicit presentation of a business model, helps to pick up all those involved in the planning process [12]-[14]. The fact that scenario planning can help to tailor business models to specific future scenarios has already been demonstrated [1]. Examples can be found for telecommunications and the Internet of Things [15][16].
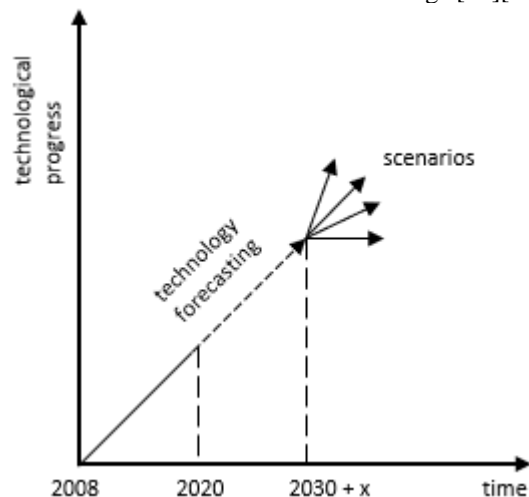

Figure 1. Combination of technology forecasting and scenario planning [10]

The authors Bouwman and van der Duin combine technology forecasting with scenario planning [10]. Consequently, they developed the business model stresstesting method as an approach to operationalize the approaches of business model innovation in connection with scenario planning [1][3][17][18]. They thus create an opportunity to develop scenarios and use them as input for the analysis of business models [18]. This method can be used to demonstrate the robustness of business model components against one or more future scenarios [1]. Business model stresstesting is therefore defined as follows [3]:

> "[...] a systematic analysis of the robustness (i.e., long- term viability as well as feasibility) of BM components - such as a value proposition, revenues or cost structure – based on different future conditions (or uncertainties)."

This means business model stresstesting combines future uncertainties by using scenarios with business model ontologies [3]. The resulting analyses and estimates of the effects of scenarios on business model components can be used to identify the components that are particularly affected under the given circumstances and therefore require increased attention in planning. The results enable users to assess whether an existing business model can meet technical, regulatory, or other changed conditions and which

business model components may need to be modified. In a three-part case study, Bouwman et al. [3] were able to successfully test the functionality of this still relatively new method. Real business models from the health care and transport sectors, as well as that of a charity organisation were used for this [3]. The applicability of the method for technologies that are still in an early stage of development and for which there are no or only little tested implementations in business models could also be proven [19].

III. STRESSTESTING PROCEDURE FOR BUSINESS MODELS IN ORDER TO IMPLEMENT BLOCKCHAIN TECHNOLOGY

Bouwman et al. developed the business model stresstesting method in the form of a six-step process as a structured approach to identifying robust or non-robust business model components [1][18]. These original steps are (1) the selection and description of a business model, (2) the identification and selection of stressfactors, (3) the comparison of the business model components with the selected stressfactors, (4) the presentation of the influences of the stressfactors on business model components with a heat map, (5) the analysis of the heat map and (6) the drawing of conclusions about weaknesses of the business model.

For the application of the stresstesting method to assess the consequences of implementing the Blockchain technology in an existing business model, adjustments to the known procedure are required. In the following, the process including the changes will be described.

Step 1: Selection and description of a business model

According to Bouwman et al., the first step in the stresstesting procedure consists of describing the business model in an explicit form [3]. If a company operates several business models, one must be selected for the analysis. A possible tool for adequately describing the business model is the Business Model Canvas following Osterwalder and Pigneur [1][22]. De Vrij notes that the Business Model Canvas in combination with the Value Proposition Canvas contributes in particular to the functioning of the stresstesting [21].

Step 2: Identification and selection of stressfactors

In the second step, it is necessary to select those factors that are to be tested for their impact on the business model components. These in general include trends and uncertainties [3]. For each factor, two opposing, extreme characteristics should be defined [1]. In the application considered here, the existence of a Blockchain is predefined as the relevant stressfactor for the procedure. The respective concrete characteristics of this Blockchain variant with regard to user rights and access to the consensus mechanism should fit the underlying business model. Such a Blockchain

variant could be, for example, a private-permissioned or a public-permissioned Blockchain.

The two opposing characteristics of this stressfactor are also predefined. The first variant is the implementation of the Blockchain in the existing business model. The second, opposite variant is the decision against an implementation, under the assumption that such a Blockchain nevertheless exists in the environment of the company. The analysis thus shows the effects of the implementation on the one hand and the consequences for the existing company on the other if competitors implement such a model.

The plausible description of this stressfactor plays a decisive role in the procedure and validity of the stresstesting [10]. A further substep for the design and description of this stressfactor therefore appears necessary. For this purpose, the business model ontology is again applied to simulate a hypothetical business model which can be used as a reference for the changes in the original business model components. In this way, the abstraction level of the stressfactor and that of the business model can be raised to the same level [10].

The Business Model Canvas following Osterwalder and Pigneur has already formed the basis for specific applications several times since its initial presentation [9]. There are already several approaches for adapting the Business Model Canvas for the Blockchain technology.

Burgwinkel retains the nine business model components, but develops new guiding questions for each component, which facilitate the application to the Blockchain technology. In order to facilitate the description of a hypothetical, Blockchain-based business model in the stresstesting process, the guiding questions as implemented by Burgwinkel can be applied [23]. The structure of the nine business model components is retained in order to enable a comparison with the business model defined in the first step of stresstesting [3]. These guiding questions are presented in Table 1.

TABLE 1 GUIDING QUESTIONS FOR THE BUSINESS MODEL CANVAS ACCORDING TO BURGWINKEL

Business Model Component	Guiding Questions
Key Partners	• Who are the partners or industry consortium for the development of the Blockchain application? • Is the new Blockchain application in competition with other traditional partners (such as banks)? • Why do the partners get involved (do they not want to miss a trend or do they see it as an innovative opportunity)? • Are there cross-industry partnerships that generate new benefits? • How are national and international supervisory authorities and industry committees involved? • Will the Use Case become an alternative to traditional approaches or does it offer a completely new benefit?
Key Ressources	• Which services does the Blockchain platform serve as a foundation?
	• Which special resources or functions/capabilities are realized by the use case?
Key Activities	• Does the application use an existing Blockchain platform (such as Ethereum) or is a standalone application built? • How are customers/users motivated to use the application and possibly pay for it?
Value Proposition	• Which customer problems are solved with the Blockchain application? • What value is created for the customer, e.g. increased trust or the advantage of not being dependent on a central provider? • Why do the participants want to use Blockchain and not a traditional technology? • Why will the Blockchain application establish itself in the market and replace traditional offerings?
Customer Relationships	• Which new relationships does the Blockchain application enable, e.g. direct contact between customer and producer without the involvement of middlemen? • For business-to-business applications: which participants (suppliers, inspection bodies, producers etc.) use the Blockchain for their coordination?
Channels	• Through which channels do customers use the Blockchain application? • Are these channels completely new or is the Blockchain application integrated into existing e-commerce processes? • What is the advantage of omitting the previous central instance which coordinated the market participants and guaranteed trust?
Customer Segments	• For which customers/users does the Blockchain application create value?
Cost Structure	• Why does a Blockchain offer technical advantages in the application scenario or why can costs be saved compared to traditional technologies?
Revenue Streams	• Which business concept/sources of income do the founders of the Blockchain application pursue? • Which business concept does the operator of the Blockchain platform (e.g. Ethereum) pursue?

Step 3: Mapping of the business model components with the stressfactors

The third step is the actual stresstest and consists of a description of how the business model components behave against the background of the stressfactor and its characteristics. This is done by describing in detail the relationship between the stressfactor and the individual business model components [1][3].

Step 4: Presentation of the influence on the business model using a heat map

In the fourth step of stresstesting, the potential impact of the Blockchain stressfactor on the respective business model components must be assessed. Based on this qualitative assessment, a heat map is drawn up using a colour scheme. The colour scheme illustrates the extent of the impact on the component [10]. Bouwman et al. and Haaker et al. define four colour levels for this purpose [1][3]:

- Red: The effect of the stressfactor on the business model component makes this component appear as no longer feasible. The effect of the stressfactor can potentially render the business model as a whole unsustainable.
- Orange: The effect of the stressfactor on the business model component makes this component appear to be no longer feasible. The business model component must therefore be considered separately and adjusted if necessary.
- Green: The stressfactor has an influence on the business model component but does not negatively affect the feasibility and usefulness of the component. If circumstances permit, a positive influence of the stressfactor on the component can be realized.
- Gray: The stressfactor has no relevant influence on the business model component.

The respective classification of the stressfactor in the colour categories must be documented and justified [1].

Step 5: Analysis of the heat map

After the heat map already shows which components are not robust, the fifth step is to analyse the heat map in order to uncover possible overarching weaknesses of the business model. The analysis can be divided into two partial analyses [20]:

Sub-View Analyses

In a Sub-View analysis, individual areas of the heat map are considered separately [1]. Problem areas can thus be identified by a horizontal or vertical view of the heat map [20]. Accordingly, a horizontal view of the columns provides an overview of the effects of all the characteristics of all stressfactors on a business model component. The vertical view of the columns provides a focused view of the effects of one stressfactor on all business model components [1][20].

Pattern Analysis

By taking a holistic view of the heat map, patterns can emerge, e.g., what characteristic of a stressfactor would be the ideal state for the business model. Furthermore, it is possible, for example, to identify whether business model components lose their usefulness under any given scenario [20].

Step 6: Conclusion on weaknesses of the business model

Once the analysis of the robustness and vulnerability of a business model has been completed, the next step is to formulate measures based on the insights gained [1]. This step is broad in scope, but usually includes recommendations for improving weak business model components or improving consistency within the business model [20].

This modified procedure of stress testing for business models provides a concrete tool for analysing existing business models against the background of implementing the block chain technology. It not only evaluates the effects of the implementation in an existing business model, but also the consequences of an implementation in the company's environment.

IV. CONCLUSION AND FUTURE WORK

The Blockchain technology still appears to be relatively new when seen from an economical perspective. To enable a wider range of applications for this technology, tools have to be created that make the technology accessible to economists. Using the existing research on the business model ontology offers the possibility to adapt tools for this new application. The combination of the technology forecast with the scenario planning within the business model Stresstesting is such a tool. By extending this approach by a Blockchain use case, economists can analyse their own or hypothetical business models against this emerging technology. The approach presented here provides a first structured roadmap for this purpose. Existing business models can be analysed, and new business models can be planned. Future research could further extend this approach especially with respect to quantifying the analyses. Furthermore, the procedure presented is based on subjective assessments of the impact of the technology on the business model components. Future research work could attempt to make this process more objective by means of further sub-analyses.

REFERENCES

[1] T. Haaker, H. Bouwman, W. Janssen, and M. de Reuver, „Business model stresstesting: A practical approach to test the robustness of a business model." Futures, vol. 89, pp. 14-25, 2017.

[2] M. Heikkilä, et al., "Business Model Innovation Paths and Tools." In Bled eConference, p. 6, 2016.

[3] H. Bouwman, J. Heikkilä, M. Heikkilä, C. Leopold, T. Haaker, "Achieving agility using business model stress testing." Electronic Markets, vol. 28, no. 2, pp. 149-162, 2018.

[4] B. W. Wirtz and M. J. Thomas, „Design und Entwicklung der business model-innovation." In Kompendium Geschäftsmodell-Innovation, pp. 31-49, 2014, Springer Gabler, Wiesbaden.

[5] W. Nowiński and M. Kozma, „How can Blockchain technology disrupt the existing business models?" Entrepreneurial Business and Economics Review, vol. 5, no. 3, pp. 173-188, 2017.

[6] A. Agrawal, S. Laddha, and M. S. Devi, "Impact and Uncertainty of Blockchain Usage on Supply Chain." Studies in Indian Place Names, vol. 40, no. 68, pp. 438-446, 2020.

[7] J. Brink and M. Holmén, "Capabilities and radical changes of the business models of new bioscience firms." Creativity and Innovation Management, vol. 18, no. 2, pp. 109-120, 2009.

[8] T. Rayna and L. Striukova, "From rapid prototyping to home fabrication: How 3D printing is changing business model

innovation." Technological Forecasting and Social Change, vol. 102, pp. 214-224, 2016.

[9] C. M. DaSilva, P. Trkman, K. Desouza, and J. Lindič, „Disruptive technologies: a business model perspective on cloud computing." Technology Analysis & Strategic Management, vol. 25 no. 10, pp. 1161-1173, 2013.

[10] H. Bouwman and P. van der Duin, P. "Technological forecasting and scenarios matter: research into the use of information and communication technology in the home environment in 2010." Foresight, vol. 5, no. 4, pp. 8-20, 2003.

[11] A. L. Porter, A. T. Roper, T. W. Mason, F. A. Rossini, and J. Banks, "Forecasting and management of technology", vol. 18, 1991, John Wiley & Sons.

[12] M. Godet, "The art of scenarios and strategic planning: tools and pitfalls." Technological forecasting and social change, vol. 65, no. 1, pp. 3-22, 2000

[13] A. Osterwalder and Y. Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers.", 2010, Hoboken: Wiley.

[14] C. Leopold, "How do SME's use Business Model Stress Testing?", 2015, TU Delft

[15] U. Killström, et al., "Business models for new mobile applications and services.", MobiLife, 2006.

[16] J. F. Tesch, "Discovering the role of scenario planning as an evaluation methodology for business models in the era of the internet of things (IoT)" In Twenty-Fourth European Conference on Information Systems (ECIS)–AIS, 2016.

[17] M. Niemimaa, J. Järveläinen, M. Heikkilä, and J. Heikkilä, "Business continuity of business models: Evaluating the resilience of business models for contingencies." International Journal of Information Management, vol. 49, pp. 208-216, 2019.

[18] H. Bouwman, et al., „Business models tooling and a research agenda." The first, vol. 25, pp. 1-28, 2012.

[19] L. Klomp, "The impact of Blockchain technology on insurance business models: Stress testing the insurers' business models using the STOF Model", 2018, TU Delft

[20] T. van Beusekom, "Testing Business Model Innovation Tooling for Small and Medium Sized Enterprises: A Multiple Case Study on the Business Model Stress Test.", 2017, TU Delft.

[21] X. de Vrij, "Decentralised Local Energy Markets: Evaluating the Impact of Blockchain Technology on Local Energy Markets.", 2018, TU Delft.

[22] A. Osterwalder, Y. Pigneur, and C. L. Tucci, "Clarifying Business Models: Origins, Present, and Future of the Concept." Communications of the Association for Information Systems, vol. 16, pp. 1–25, 2005.

[23] D. Burgwinkel, „Blockchaintechnologie und deren Funktionsweise verstehen." In D. Burgwinkel, Blockchain Technology: Einführung für Business- und IT Manager. 2016, Basel: De Gruyter Oldenbourg.