How SMEs Can Use Games to Assess the Innovation Potential of New Technologies

Martin Kinitzki, Dieter Hertweck, Peter Kühfuß, Valeria Kinitzki
Reutlingen University
Faculty of Informatics
Alteburgstr. 150, 72762 Reutlingen, Germany
martin.kinitzki@reutlingen-university.de
dieter.hertweck@reutlingen-university.de
peter.kuehfuss@student.reutlingen-university.de
valeria.kinitzki@student.reutlingen-university.de

Abstract. *With the digital transformation being one of the most discussed topics in the business world today, many enterprises – especially small and medium sized ones – find themselves struggling with the understanding of new digital technologies and thus the potential benefits and risks for their companies. New technologies like the Internet of Things, Blockchain or Machine Learning have great potential for businesses. However, carefully evaluating and selecting purposeful technologies – aligned to the digital strategy – is the key to success. Technologies appear, change and also vanish so rapidly in the digital age, that a proper understanding is crucial for a sustainable technological foundation. Focusing on the characteristic features of technologies, the presented approach promises to create a better technological understanding for decision makers in small and medium-sized enterprises (SMEs) in a playful manner: With a serious game that fosters insight and allays fears of digitalization.*

Keywords. digital innovation, technologies, digital skills, serious game, SMEs

1 Introduction

The increasing digitalization driven by paradigm shifts like the Industry 4.0 or the Internet of Things puts companies under great pressure and forces them to develop new business models to remain competitive on global markets (Briken 2015; Schallmo et al. 2017; Wolan 2013). The literature states that the digital transformation should be considered the basis of a technical and economical paradigm shift influencing economy and society as a whole (Blättel-Mink and Menez 2015; Picot et al. 2017). Being innovative and transforming into the digital age is often reduced to the implementation of new technologies. But there is no digital transformation without appropriate business transformation and the consequences of ignoring or escaping the trend become very clear with examples like Kodak, where the company was unable to make a transition into digital thinking, causing its own downfall due to the disruptive character of digital photography. But it is not the global players or startups that struggle the most, especially decision makers in SMEs suffer from the digital revolution as they still lack competences to cope with the challenges arising from the digital transformation and find themselves in a completely different situation compared to big companies who employ technology experts or startups that found their digital business models on top of digital natives' competencies.

Proper instruments on how to cope with the digitalization for SMEs are provided by the European transnational research project Digitrans. The project's main objective is to enable SMEs to create competitive and sustainable innovative business models. It offers a transformation method divided into an innovation phase that is linked to an innovation space design and an organizational implementation phase supported by an online platform that provides training content and self-assessment tools. The method is provided in innovation trainings and workshops to more than 300 SMEs.

After the first trainings, three main deviations from transformation processes in global companies and investor financed startups can be stated: (a) different level of technological awareness of decision makers before they enter business model development procedures; (b) hierarchical B2B customer value chains with little to no customer integration opportunities into the innovation process; and (c) the need of cost benefit calculations and feasibility analysis in early stages of the business model development process. These characteristics derive from the fact that – compared to startups – SMEs do not start their innovations on a green field but have to cope with change management and the actual transformation of existing business models. Unlike large global companies SMEs are often lacking dedicated human and monetary resources for trial and

error approaches, not to mention the dedicated personnel like Chief Digital Officers (CDOs) that global companies employ. For most of the SMEs that are not in the position of bringing new know-how into the company by hiring digital experts or integrating startups into their structures, it is up to the company owners or CEOs to acquire the crucial knowledge of digital strategies and technologies.

That is why the goal set for the innovation method development was to make the drivers of digital transformation more comprehensive to the owners and managers of SMEs. A feasible innovation method has to support them to discover innovation potentials for their businesses by raising their technological awareness and allaying their fears of becoming the "digital prey" by means of a serious game concept. Serious games have been tested in the past as an interesting alternative to bring business knowledge to decision makers in SMEs (PLAYITIL, 2018).

Working on the nature of serious games to educate decision makers, the chosen research approach consists of two methodological dimensions: (a) Gaining basic features of digital technologies by decomposing them to an atomic level; and (b) Designing a serious game to foster technology understanding as well as identify innovation potentials for the digital transformation of SMEs.

Therefore, the focus was set on answering the following research questions: (a) What influence does technology have on the transformation process of SMEs?; (b) How can a serious game be used to raise the technological awareness of SME decision makers?; and (c) Is it instructive to decompose technologies to their characteristic features for the purpose of knowledge transfer?

In preparation of this study, a systematic literature review was conducted to examine the influence of technologies and technology understanding on digital transformation processes.

2 Methodology of Literature Review

The underlying method of literature research as shown in Figure 1 was adapted from Webster and Watson (2002). Literature was captured from (a) GoogleScholar; (b) Elsevier and (c) SpringerLink since these databases provided the most relevant results during an initial explorative search phase. Search and analysis were conducted in February 2018 using the following search keywords: *SME*, *serious*, *game*, *technologies*, *innovation*, *digital*, *skills*, *learning, disruptive, disruption, impact, influence*.

To set the focus on the latest findings, only literature published since 2005 was considered, when the definition of serious games was established by Michael Zyda in the IEEE Computer journal. Whenever possible, filter criteria restricting results to scientific papers were applied. Due to the large amount of results, the search had to be narrowed down considering titles only.

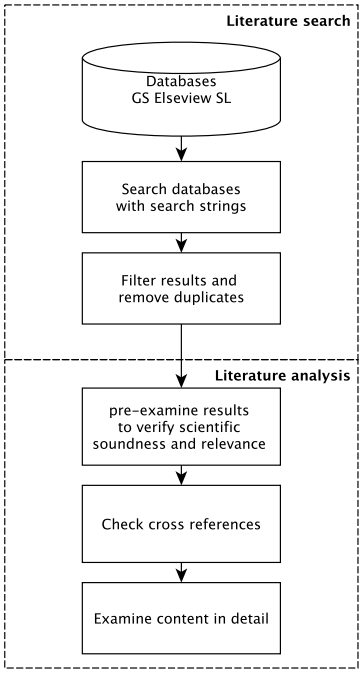

Figure 1: Process of literature research

After removing duplicates from the respective search results, a first content-related evaluation based on the documents' titles and abstracts was carried out. Results without any relevance to the object of this research had to be excluded from further analysis, as well as results which lacked scientific standards. The remaining results were analyzed in full detail. Finally, the bibliographies of highly relevant results were examined to determine further literature contributing to answer the raised research questions. During this process, 132 relevant results were identified.

3 Influence of Technologies and Technology Understanding on Digital Transformation

As early as 1982, Curran and Mitchell described our fast-changing world and its impact on managers: They are obliged to foresee the impact of technological developments on their companies and identify opportunities and threats in time. The authors describe "a basic understanding of technology's far-reaching scope" as crucial to managers in order keep up with the transformation of the business world. (Curran and Mitchell 1982) Since then, the pace of change has only increased further and the perception of information technology shifted from being purely supportive to being an enabler of new business models (Châlons and Dufft 2017). Despite the realization that the digital transformation does not spare anyone, most companies

still struggle to grasp the benefits from technologies due to the lack of proper understanding (Fitzgerald et al. 2013). Naskali et al. (2018) highlight the significance of this condition for SMEs, where functions are less segregated and decision makers are often left alone with the digitalization as they usually lack digital experts compared to global companies or startups. This leads to the requirement of a different transformation approach for SMEs.

The existing digital transformation process models found in literature assume a certain degree of digital maturity and expertise. Schallmo and Williams (2018) for instance, present a roadmap for the development of digital business models. It synthesizes existing transformation approaches and consists of five phases: (1) Digital Reality, (2) Digital Ambition, (3) Digital Potential, (4) Digital Fit and (5) Digital Implementation. None of these phases covers the aforementioned potential lack of technology understanding as seen in SMEs. For that reason, SMEs require a different entry point into the transformation process that begins with imparting knowledge about technology as an important driver of the digitalization. The transformation model presented in this paper (Figure 2) is a work in progress. It is codeveloped by empirical experiences of 7 universities in the Danube Region. As part of the Digitrans Project, it addresses this condition by providing a technology entry point into the transformation process. It is solely dedicated to fostering technology understanding of SME decision makers.

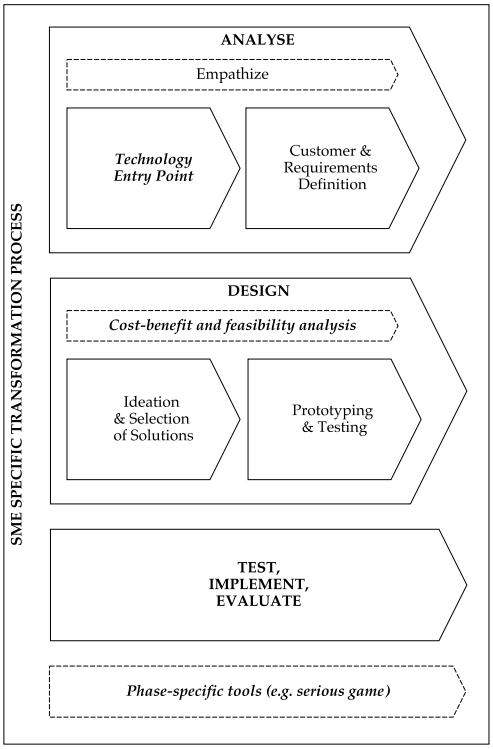

Figure 2: SME specific transformation process

Technology understanding is prerequisite for a successful transformation. The chosen serious game approach delivers the advantages of learning by playing and has the potential to tackle the existing knowledge gap.

4 Gaining Basic Technological Features by Decomposing Digital Technologies

Taking a look at the digital businesses of the last decade and their disruptive influence on economic and social levels, they all have one thing in common: their business model is mainly based on digital technologies. Whether it is Amazon or eBay that have ousted classic mail-order businesses, WhatsApp replacing SMS or Airbnb and Uber with their impact on the traditional hotel and taxi industry (Châlons and Dufft 2017). The reason for their success was the versatility of digital technologies next to lean processes due to the lack of organizational and system legacy (Fleisch et al. 2014).

In their study about Service Systems Engineering, Böhmann et al. (2014) point out the importance of technologies in cyber-physical systems – which can easily be transferred to the context of this study. The progress resulting from the connection of human and technological resources enables new forms of business models, products and services capable of developing disruptive characteristics that also affect the society as a whole (Böhmann et al. 2014; Kempf 2013). Social revolutions like crowdfunding and the current form of shareconomy would not have been possible without the technologies and know-how available at that time. It becomes clear that the digital transformation is far more than just "transferring analog information to digital medium" (Hamidian and Kraijo 2013).

Researchers and scientific literature covered in the conducted literature research concur that technology has an immense influence on life and business and missing the chance to innovate, might decide whether a company will survive or not. The discovery and further understanding of the impact that diverse technologies have on businesses and society marks an interesting object of research. Such studies usually take place over a period of several years in which success stories are analyzed in detail and similarities are determined. An excellent example is the St. Gallen Business Model Navigator based on a five-year study in which 250 business models were analyzed and patterns derived (Gassmann et al. 2013).

Unlike business model types, the amount of digital revolutions or technology induced paradigm shifts is much smaller and attempting to detect innovation patterns on a higher level has proven to be less expedient. Therefore, the attempt on breaking through the technologies' surfaces by dismantling them to their atomic artifacts was chosen. This marks the top-down approach of the proposed research: Collecting

technologies, structuring, cataloging and decomposing them. The foundation of this heavily knowledge-driven concept is the catalog of technologies dismantled into their essential features. Identifying these characteristic features is considered the main research objective of the approach proposed in the research study. Understanding the "nature" of a specific technology on an atomic level might be fruitful in two ways: Improve the understanding by focusing on the main features and hiding the technical frame; and determining the innovation potential for different business contexts.

An example for the decomposition is given with the blockchain technology. It describes an algorithm and distributed data structures for secure data transfers without a central administration (e.g. electronic cash transfers). It was originally designed for the crypto-currency Bitcoin and the blockchain concept was mainly driven by the rejection movement against money and bank-controlled payments regulated by governments. The original vision of the Bitcoin developers was to enable people to spend money without friction, intermediaries, regulations or the necessity to know or trust third parties (Lewis 2015; Nofer et al. 2017).

Examples for essential features that can be derived are the following:

- Secure transactions
- Trusted transactions
- Decentralized transactions
- Frictionless transactions

With these characteristics in mind – completely detached from the technology itself – one can start thinking about how businesses might enrich their business models, products or processes or even create new ones using these features. It becomes quite evident that a technology like blockchain can be transferred to other fields as its capabilities are entirely independent of its original use case – Bitcoin. From a technological perspective, blockchain allows for decentralized, secure and trusted data transactions that can be used in completely different scenarios like voting systems, signatures and legal proofs of existence or possession. Complemented by the serious game that will be used on innovation workshops with SMEs across Europe, not only an expedient way to transfer knowledge to decision makers is expected. But also interesting results examining the impact of these essential features on the organizational, cultural and technological levels of SMEs. Figure 3 depicts this proposed research approach with the combination of desk and empirical research.

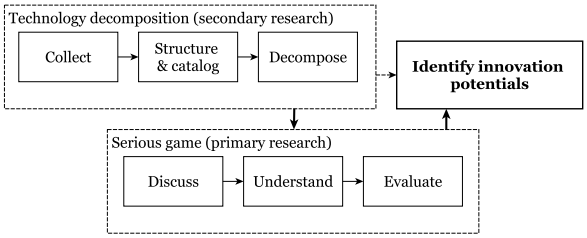

Figure 3: Proposed research approach

Besides the empirical study of intrinsic innovation potentials of technologies, the serious game concept aims at raising the players' understanding of technologies and the relation to business contexts in a playful manner. It is also considered as a proof-of-concept instrument aiming at answering the research question whether decomposing technologies is beneficial for the knowledge transfer in the first place.

5 Learning Innovation by Combination of Technological Features and Business Context - The Serious Game Approach

Playing is closely associated to learning processes and therefore paves the way to achieve learning success more easily with the acquired knowledge being transferable onto other contexts. This is the idea of serious games. (Kerres et al. 2009) A serious game refers to a game that follows traditional game mechanics but is designed to fit a different purpose than pure entertainment, like education or exploration (Breuer and Bente 2010; Djaouti et al. 2011; Göbel et al. 2014).

In terms of digital education, there is a certain demarcation between serious gaming and concepts like gamification, E-learning and game-based learning. Gamification deals with game mechanics in non-gaming situations in order to enhance motivation or influence a certain behavior (Groh 2012). E-Learning (or educational technology) refers to the utilization of technologies in education to improve the learning process and its results without the integration of playful aspects (Dichanz and Ernst 2001). Game-based learning uses games for motivation to achieve learning effects and reduce performance pressure on learners by concealing the educational aspects (Pivec et al. 2003).

The presented serious game concept is meant to educate the users about technologies by hiding the technical frame and focusing on their characteristic features. The reduction of complexity does not only prevent the players from being overwhelmed but it also allows for the validation of the aforementioned decomposition process by empirically discovering innovation potentials and problem solutions based on features rather than technological buzz terms.

As mentioned before, there is no digital transformation without appropriate business transformation and therefore technologies should always be set in relation to business contexts. The main motivation of the round-based game lies in fostering discussions about technologies and their potential as innovation drivers in these contexts. By bringing together people from different positions and departments – each with certain skills, experience and knowledge – multi-perspective debates on the subject can be conducted. It should be noted, that the tracking of resulting technological solutions with respect to a specific context is an important key aspect of the concept, as it poses the empirical part of discovering innovation potentials by contemplating technologies' essential features.

The structure of the serious card game is fairly simple as it consists of three card types only: *Technology Cards*, *Context Cards* and *Joker Cards*.

Each technology card contains a certain technology or technological concept and its set of essential features identified in the previously mentioned decomposition phase of the study.

Context cards represent specific challenges that are to be solved through the use of technologies. They mark the impulse on the discussion of technologies. Besides the predefined contexts that are meant to demonstrate the serious game approach, organization specific challenges and problems can be tackled and added to the library as well.

Joker cards represent a special kind of cards, that can be played instead of ordinary technology cards. By playing a joker card, the player can choose whether to skip the current round, take another card from the stack or replace it with a technology of choice. Joker cards are supposed to increase the dynamics of the game.

There are two roles intended in the game: a moderator and the players. The moderator creates the game by selecting from predefined sets of contexts and technologies or defining new ones, moderating the discussion and accepting or rejecting solutions. The players simply join the game, play their cards, debate and vote for the best solutions.

At the beginning, the moderator puts a context card on the table and each player receives a defined amount of technology cards. In turn, every player plays a technology card or set, justifying why it serves (as part of) a potential solution. Throughout each round, the technologies are discussed, and the best technology or combination of technologies is chosen and checked in by the moderator. If there is no suitable solution found, the context is rejected, and the next round starts. The players' card stacks are refilled and every player whose card was a part of the solution, is rewarded with game points. The solutions checked in by the moderator are stored in the system.

The game structure is based on a console-like architecture that is easy to set up with no additional hardware. The console itself is represented by an ordinary web browser and the gamepads through smart phones or tablets. With the web browser illustrating the game board managed by a moderator, the players can use their devices to interact on the board.

The underlying system architecture follows the proven three-tier architecture, strictly separating the presentation, application logic and data storage as shown in Fig. 3. With a web service as the central element of the system, the object-oriented communication between the clients and the server is established and the computation is running in the cloud, so that neither the players nor the moderator have to cope with the application's system environment. Being accessible in web browsers across all devices renders it fairly easy to play the game without any installation or configuration needed.

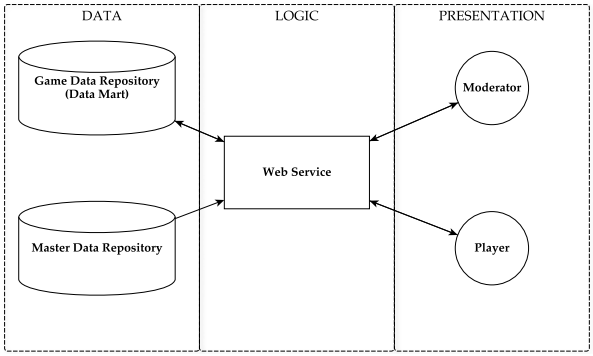

Figure 4: Game architecture

The several components of the system have to provide or enable the following main functions:

- Digital game structure
- Game moderation dashboard
- Access control
- Tracking solutions
- Recording new contexts and technologies
- Technology lookup

The presentation layer contains all views that are presented to the moderator as well as the players. This includes the game table, cards, dashboards and all information shown. It is stacked on the other two layers and provides the visuals for the underlying logic and data storage components. The communication is bidirectional, so that through the web services, operations in form of requests are received and computed and responses are provided by rendering them in the presentation layer. An important role of this layer lies in the presentation of information about technologies in order to foster the understanding by briefly explaining it to the player. This can be implemented in form of texts, images or videos showing sample scenarios of the technologies in use. Without doubt, storing all relevant data is utterly important and therefore a mature database concept is inevitable, but the representation of the data in a form that is understandable and reliable is just as important. To facilitate the accessibility, each technology card is

equipped with a question mark symbol that provides the demanded information on-click.

The web services are core of the logic layer which computes all requests sent by the moderator and players. All requests as well as the responses are visualized by the presentation layer in form of user interfaces. The required data is fetched from the databases and new data is stored in it. In the data layer, two separate databases are envisaged: One containing the master data, like predefined contexts and technologies and the other for the game instances with the data required per game.

For the future prospects, a recommender system providing the most relevant (combinations of) technologies to similar contexts is desirable – derived from the growing collection of empirical data.

6 Conclusion

With all the new opportunities and challenges emerging from the digital transformation, ignoring it puts organizations at risk of falling behind the competition. However, properly evaluating and selecting the right technologies as drivers of the transformation presents great challenges to businesses. Especially small and medium-sized enterprises find themselves struggling due to the lack of financial and human resources limiting the possibility of trial-and-error approaches on being innovative. Decision makers are often left alone with the digitalization as result of these conditions. It is inevitable to understand that the digital transformation is not going to stop, and companies will find themselves on an everlasting journey with the need to adapt, rethink and reshape constantly. A proper technological understanding and awareness is crucial to remain competitive.

The proposed research study tackles that condition by offering a way on making digital technologies more comprehensive. It helps SMEs to discover innovations for their businesses and solutions to existing problems by raising their technological awareness with a serious game. By exploring technologies and helping SME decision makers to grasp the benefits of technology in a playful manner, the prospects of this research study appear very bright.

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