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Sustainability as a criterion for business models – A framework for the life science sector

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The research discourse on sustainability and on business models can be described as diverse in approaches and understanding of subject areas. The value-oriented business model and the twenty criteria of the German Sustainability Code represent a sample which is used for this research to examine and compare the sustainability of business models in practice. In addition, the relation between digital transformation and sustainability is considered. For this purpose, influences from theory and practice are included in order to further support the combination of these two concepts. With a qualitative document analysis, the selected business model cases are reviewed for their sustainability and finally characterized with the help of established hypotheses. It can be stated that sustainability aspects are potentially present in business models in the health care sector, but that there are clear deficits in the development and strategic anchoring. A first proposal for a solution is presented in the form of a framework.

1 Introduction

The life science industry and especially the health sector has gained major interest over the last years. Its increasing interest in digital solutions for treatments and healing methods and the promotion of solutions for these approaches is strongly evolving. Still, the sector is highly regulated by several laws such as the law for secure digital communication and healthcare applications, also known as the e-health law (Federal Ministry of Health, 2019). This law benefits the distribution of the IT-infrastructure and therefore helps to promote the network and digitalization. The new digital-care law is especially favorable to digital health applications. These applications are supposed to especially improve the care of insured people (German Parliament, 2019). The digital care law should help to include more health applications in the service catalogue of the statutory health insurances. Data-driven healthcare is becoming more important, digital transformation and platforms define new business models in the sector. Even though the healthcare sector is not as advanced as other industries in the field of business model innovation in Germany, it is even more important to be as dynamic as possible to adapt the constantly changing needs (Granig and Lingenhel, 2016). For this purpose, Granig and Lingenhel (2016) have designed a model: 1. analyze trends, 2. generate ideas, 3. create/innovate business model, 4. pilot project, 5. implement business model, 6. evaluate results. With this approach, business models in the health sector can be improved and adapted. Their intention is to start with trend recogni-

tion and thus to be able to generate a fast implementation, to determine their own strengths and weaknesses and to then derive the individual idea and the resulting market position.

Regarding Ahrend (2016), not much research has been done concerning business models in the health sector combined with sustainability as criteria. Thus, the present article aims to expand the research discourse on sustainable business models. It does so by developing theory- and practice-oriented hypotheses and providing the research field a model design in the context of the health care and life science industry. With increasing economization, changes in patient care and the corresponding interest in interpreting these changes in terms of patient well-being, Ahrend (2016) sees the niche of this emerging market.

The importance of digital transformation owing to constantly changing needs and therefore the growing market of digital health start-ups was already detected twenty years ago (Deluca and Enmark, 2000). The ecosystem which developed around these mostly digital start-ups is marked by investors and support such as the Flying Health Incubator GmbH. As an incubator in the health sector it has gained major responsibility for its value creation. Due to this importance it was chosen as one of the case-studies in this article and will be examined later. Another organization to be named with a global program for digital health start-ups is G4A, formally known as Grants4Apps and founded in 2013. By now, the accelerator of the chemical and pharmaceutical group Bayer no longer only supports the funding of app projects in digital health. It provides a whole program for entrepreneurs in the digital health sector including office space, start-up financing, mentoring and also Venture Design as a young business unit (G4A Bayer, 2020).

There will be a gain in knowledge especially at the organizational level for the management of health therapy facilities among others, as well as for organizations working at the intersection with the health sector, for organizations and associations in the health sector and other actors in the industry. Business models can be explicitly set up, compared and, if necessary, ideas for improvements can be extracted. On an individual level, the topic is of interest for those in health education, for therapists and physicians who are already practicing. Furthermore, it is useful for those actors, who are about to start their own business, are developing business models in the health sector and are looking for investors.

This article discusses the question of *what business models in the health sector look like, how they might be characterized and why it is worthwhile to compare them in terms of sustainability*. The objective is to expand the existing business model research discourse in combination with corporate sustainability research by reviewing both literature and business cases to develop it further. The proposal of this article is an extended value-based business model approach for the life science sector on the basis of analyzed sustainability criteria to integrate economic, environmental and social concerns into a holistic business model view.

2 Sustainability and business models in life science – A review

2.1 Sustainability

The concept of sustainability is treated as the main guiding principle in this article. The established hypotheses for comparing the business models are based on the idea of sustainability and are developed from this theoretical construct. Hence, sustainability is understood as a strategic corporate task, which means that the implementation of a concept is the responsibility of corporate management (Kanning, 2008).

The underlying definition of sustainable development is based on the Brundtland Report - Our Common Future - which was published

under the leadership of the Norwegian Prime Minister Gro Harlem Brundtland. It states that development is about meeting the needs of the present without depriving future generations of the possibility of satisfying their needs (WCED,1987).

The German Council for Sustainable Development (RNE) was first appointed by the German government in April 2001, to improve social communication and to provide consulting. It defines sustainability as the fact that environmental, social and economic criteria must be taken into account in equal measure, and that it is everybody's duty to leave an intact ecological, social and economic system for future generations (RNE, 2010). Hauff (2014) for instance sees the goal of sustainable development in the permanent fulfilment of basic human needs, taking into account the capacity of the natural environment, by which he specifically mentions the social and environmental components.

This article is based on the classic three-pillar model of sustainable development, which was first formulated in 1997 by the European Union. According to this principle, the social, environmental and economic approaches are equally pursued and related to sustainability (IHK Nürnberg, 2015). The balance of the three dimensions are seen in the understanding of strong sustainability (Kanning, 2013). Strong sustainability means that none of the types of capital may fall, but individually rise - they are therefore not substitutable as in weak sustainability (Hauff,2014).

The three dimensions are composed of Economy, Culture and Social, which stand on the foundation of Natural Resources / Climate. This dependency implies that each of them must remain intact (Stahlmann, 2008; Corsten and Roth, 2012).

Sustainability criteria refer to criteria that describe, characterize and promote the nature of sustainability. The concept to be applied should be based on objectives for the improvement of the sustainable corporate management (Ahrend, 2016). For this reason, the criteria of the German Sustainability Code (DNK) of the RNE (2016) are chosen and used as the analytical framework to examine the business models. It consists of the four areas of strategy, process management, environment and society which are assessed with a total of twenty criteria (Table 1). In concrete terms, this approach is

Table 1 Sustainability criteria matrix (in allusion to RNE, 2016).

Strategy	Process Management	Environment	Society
1. Strategic analysis and measures	5. Responsibility	11. Use of natural resources	14. Employee rights
2. Materiality	6. Rules & processes	12. Resource management	15. Equal opportunities
3. Objectives	7. Control	13. Climate relevant emission	16. Training
4. Depth of the value chain	8. Incentive systems		17. Human rights
	9. Stakeholder participation		18. Community
	10. Innovation and product management		19. Political influence
			20. Law & directive-compliant behaviour

particularly useful for small and medium-sized organizations with a need of EU reporting and as a control instrument for sustainable management.

Strategy (RNE, 2016):

- The first criterion - *strategic analysis and measures* - is used to show what opportunities and risks are based on the main activities and in relation to sustainable development and under what standards this is done. Concrete measures can be listed here as well as the possibility of integration into the value creation process.
- *Materiality* expresses the influence which different aspects of sustainability have on business activities, the strategic consideration and how the core business affects the environment and society.
- The criterion of *objectives* describes how the company has set qualitative and quantitative sustainability objectives and the extent to which these are measurable and verifiable. This is only possible if the time of target achievement is clearly defined.
- *The depth of the value chain* is a criterion for demonstrating the significance of sustainability aspects for value creation and how profoundly they permeate the process.

Process management (RNE, 2016):

- *Responsibility* as a criterion sees accountability in corporate management, enabling direct intervention in decisive strategic measures.
- *Rules and processes* are used to present and implement sustainability strategies in business operations.
- The *control* criterion discloses management indicators that help to plan and control sustainability. Consistency, reliability and comparability are relevant factors here.
- *Incentive systems* are used to determine how the rewards of employees and employers are oriented towards the achievement of sustainability goals and long-term value creation.
- *Stakeholder participation* describes the identification of stakeholders, their involvement in the sustainability process and the resulting frequency and form of communication.
- The *criteria innovation and product management* provide information on the extent to which organizations use innovations to reduce their own resource consumption and that of their stakeholders.

Environment (RNE, 2016):

- The *use of natural resources* describes the extent to which they are used and the resulting emissions.
- *Resource management* explains the objectives in terms of resource efficiency, the use of renewable energies, increasing raw material productivity and reducing the use of ecosystem services.
- *Climate-relevant emissions* are listed again separately and describe the concrete reference to greenhouse gas emissions and the planned targets for reducing these.

Society (RNE, 2016):

- *Employee rights* disclose which recognized standards are pursued in the company in this regard and how the participation of employees in sustainability issues is supported.
- Equal opportunities show how diversity, occupational health and safety, immigration, appropriate wages and work-life balance are respected.
- *Training* outlines what the company is doing to promote the employability of all employees in the light of demographic change.
- *Human rights* are intended to prevent problems in the form of forced and child labor and exploitation of any other kind, and to describe what the company is doing about

it.

- The *community* criterion aims to show what measures the organization takes to make a contribution in the regions with the most important business activities.
- *Political influence* on decisions and developments in the form of membership fees, lobby lists, donations to political parties and other actions in this area should be disclosed.
- Finally, the *law and directive-compliant behavior* is considered in order to show which measures exist to prevent illegal behavior and, in the event of it being detected and sanctioned.

Due to the visualization, sustainability performances can be made transparent and comparable in order to assess how organizations anchor sustainability in their core business. With the Sustainability Code as a voluntary instrument on behalf of the Federal Government, RNE intends to give new impulses to the concept of sustainability in business and society. Furthermore, there is the possibility of a declaration of conformity for organizational communication and adaptations to different industry sectors. A DNK database is available for this purpose, in which, among other things, the declaration of compliance with the twenty criteria must be filled in. This reporting obligation, which has been in force since 2017, is covered equally and is in conformity with the law, and is legitimized by the EU Commission as a corresponding instrument (RNE, 2017).

2.2 The business model approach

Osterwalder et al. (2005) define business models as a conceptual tool supporting the business logic of an organization. It contains several elements, the relationship between these elements and to external actors as well as different concepts. The challenge is to display the simplified descriptions and representations of the concepts and relationships, what value is presented to the customers under which circumstances and with what financial consequences. Accordingly, it is a conceptual tool for demonstrating any constructs, subjects and processes that represent the business intention of an organization. Further definitions declare the presentation of several aspects of the resource transformation just like the relations with other market participants (Becker and Ulrich, 2013), as well as the representation of the central logic and strategic decisions to create and capture both social and economic values within a value network (Dahan et al. 2010). Demil and Lecoq (2010) describe it as the articulation between the different business areas and the way the organization creates sustainable value.

Furthermore, the delimitation between strategy and business models needs clarification. Osterwalder (2004) perceives strategy as being translated and implemented into the business model. Becker and Ulrich (2013) see strategies as dynamic and action-oriented, while business models are static (structure-like) or can be understood as dynamic (structuring). Hence, Bieger and Reinhold (2011) as well as Lüdeke-Freund (2017) position the business model between the strategic and operational level. It intends that the group of values and value mechanisms are established from strategic success positions. The objective of a business model in sustainable terms is the long-term nature in social, economic and ecological aspects (Ahrend, 2016). Therefore, the conceptualization of Bieger and Reinhold (2011) the value-based business model is used here as the conceptual foundation (Figure 1). The holistic and generic nature of this business model and its elements is particularly suitable for comparing different organizations.

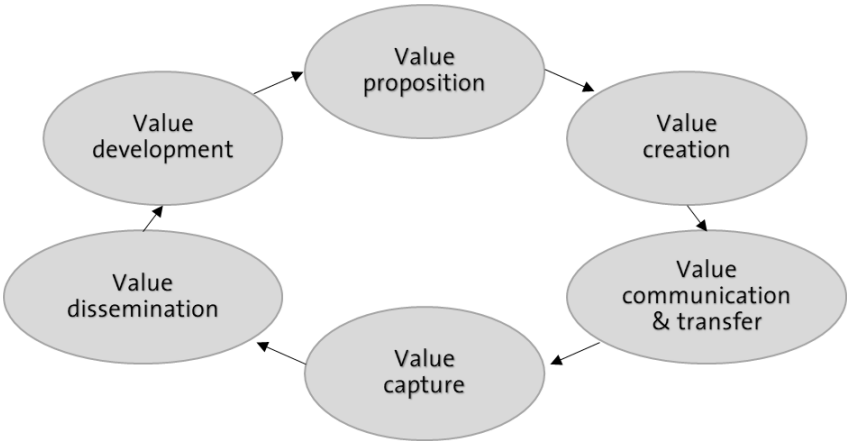
Their approach provides a six-step model which is based on the creation of monetary and non-monetary value not only for the organization itself, but its stakeholders. It is dynamic and includes elements of business development and change. The individual business mod-

el elements interact within a business model architecture, whereas sustainability is understood here as the continued existence of the company and is also measured within it. To ensure the longevity of the organization, the following elements serve in synergetic cooperation:

- Value proposition - contains the organization's offer in the form of a value proposition for the customer.
- Value creation - shows how value is created through resource combinations of both internal and external capabilities in a value network.
- Value communication and transfer - communicate the transfer of the created values to the customer, the form and the way
- Value capture - shows how the value created is returned to the company in the form of revenues.
- Value dissemination - regulates the distribution of values and revenues within the organization and stakeholders.
- Value development - describes the continuous qualitative and quantitative improving value creation from an evolutionary and revolutionary perspective.

Another approach to be considered in this context is that of "sustainable entrepreneurs" according to Morris, et al. (2005). In this approach, the need for sustainability in business models is specifically identified and included accordingly. Since ultimately the question of sustainability as a criterion in business models is fundamental to this work, this model is presented here. The underlying understanding of business models is based on the assumption that they provide a compact summary of the decision variables of a company, which are reflected in the anchoring corporate strategy, architecture and economics and, in combination, ensuring sustainable competitiveness (Morris et al., 2005). They identify the difficulty in standardizing business models that generalized models are often too bold, while they still meet the individual needs of the organization. Accordingly, they propose an approach that serves different levels of strategic decision-making - "foundation", "proprietary" and "rules" (Morris et al., 2005). In the following the levels are understood as foundation, individual nature or characteristic, and rules where each

Figure 1 Value-based business model (in allusion to Bieger and Reinhold, 2011).



contains six basic decision areas (Table 2):

- At the foundation level basic decisions are made regarding the basic activities of an organization, which are supported by the following questions: 1) How does the organization create value? (supply factors) 2) For whom does the organization create value? (market factors) 3) What is the competence source? (skills) 4) How can the organization compete for a position? (competitive strategy) 5) How does the organization earn its money? (Economic factors) 6) What are the time, size and ambitions in the field of technology?
- In comparison to the first level, the sustainable approach is formed on the second level in such a way that this level emphasizes the specific unique selling propositions of an organization and thus represents the level that is more difficult to imitate for competitors.
- The third level represents the operational rules, which ultimately bundles the preceding two elements into instructions for action and represents them in strategic management decisions (Morris et al., 2005).

"Sustainability requires that model components demonstrate consistency" (Morris et al., 2005), which means that the individual components of a business model have to last, and there must be no contradictions between the individual core activities, both internally and externally.

An interconnection can be drawn, among others, to the sixth element of the value-based approach, in which development is differentiated into quantitative growth, evolutionary adaptation, and which also takes the view that on the external level, a change in the environment implies a change in the organization, while internally the individual components are mutually dependent (Bieger and Reinhold, 2011; Morris et al., 2005).

The entire concept of Morris et al. (2005) serves as a framework for entrepreneurs at the time of foundation to formulate core elements and intentions, to achieve consistency between the individual elements and to create individual attributes for sustainable competitiveness. For this reason this model in combination with the value-based approach of Bieger and Reinhold (2011) is considered the foundation for the

Table 2 Sustainable entrepreneurs - model (in allusion to Morris et al., 2005).

LEVEL	DECISION AREAS
Foundation	1. How does the organization create value? (supply factors) 2. For whom does the organization create value? (market factors)
Individual character	3. What is the competence source? (skills) 4. How can the organization compete for a position? (competitive strategy) 5. How does the organization earn its money? (Economic factors)
Rules	6. What are the time, size and ambitions in the field of technology?

analysis of business models.

2.3 The research discourse on business models and corporate sustainability

Regarding the research discourse between developing business models and corporate sustainability, Lüdeke-Freund (2017) presents the relevant topics such as corporate sustainability and sustainable business models for corporate competitiveness and the fulfilment of strategic goals, such as ecologically and socially responsible action (Lüdeke-Freund, 2017; Lüdeke-Freund, 2009; Lüdeke-Freund et al., 2016). Building on the understanding of Schaltegger et al. (2016), Lüdeke-Freund (2017) understands sustainable business models as a value-creating concept for interest groups. It initially does not further damage the three dimensions of the understanding of sustainability - ecological, social and economic. If necessary it even regenerates them and thereby represents an "ideally designed and implemented value creation logic" (Lüdeke-Freund, 2017). Sustainable entrepreneurs achieve their business goals with the help of business cases for sustainability. They are dedicated to the conditional economic success and at the same time have positive effects on environment and society. For the corresponding design, Lüdeke-Freund (2017) distinguishes between three different phases as a preliminary consideration based on Wunder (2013): business model analysis, business model innovation and business model implementation. The business model analysis contains the success and strategy potential; the business model innovation the sustainability potential; and the business model implementation contains the introduction of new value creation logics oriented towards sustainability dimensions. With regard to sustainability, Lüdeke-Freund (2017) continues to distinguish between "success through and success with sustainability". While success through sustainability stands for using core businesses of the company to introduce sustainable conditions, success with sustainability appeals to short-termism and temporarily seizes market opportunities. He also sees the integrative creation of sustainable values, ecological, social and financial as relevant in the sense of entrepreneurial action.

Kandolf (2016) describes how start-ups develop a sustainable business model. He understands sustainability of business models as longevity on the market. It is therefore particularly interesting for start-ups and founders, where the survival and subsequent maturation of an idea is first of all important. Therefore, he relies on the business model canvas approach of Osterwalder and Pigneur (2011) with its nine elements, and recommends to include it in a three -step approach. Step one involves working out the nine elements to make the idea concrete. Step two is the systematic development phase, in which strategic instruments are used to verify correctness and the business model approach becomes more concrete. The process in this stage contains corresponding tools such as industry structure analysis, customer profiling, revenue models and the marketing mix. The results are then transferred to the business model canvas again and tested in a test phase. Step three incorporates the corresponding changes resulting from the feedback into the business model and the result according to plan is a validated business model (Kandolf, 2016). It is clearly evident here that the term sustainability in the three-dimensional understanding plays a rather subordinate role and is ultimately purely responsible for the successful introduction of a new business model to the market.

Broman and Robèrt (2017) have designed an approach in a framework model, "the FSSD has been designed to promote a thorough understanding of both the full scope of the sustainability challenge and the related opportunities". The question why business models are important for sustainability is the research question of Bocken et al. (2014).

Thus, Ahrend (2016) sees few viable ap-

proaches and therefore suggests further research in the discourse on corporate sustainability. This is again why this article emphasizes the relation between corporate sustainability and business models and proposes a framework to the research question presented above.

2.4 Methodology

For this purpose, a qualitative empirical document analysis is conducted. Five different cases from the health sector are considered as objects of investigation and evaluated in form of a case study analysis according to the understanding of Yin (2003). The selection has to be as heterogeneous as possible with regard to the service concept and as homogeneous as possible with regard to the number of employees in order to ensure comparability. The organizations selected for the case studies due to their accessibility are Sonormed GmbH, Medlanes GmbH, Flying Health Incubator GmbH, DockCheck Medical Services GmbH and In good Health. The data sources used were primary and secondary online accessible data. It most concretely reflects the business models of the individual cases and thus contribute to the explanation of the phenomenon investigated. By using secondary sources and incorporating current company data, a detailed view of the respective business models and thus the empirical data basis for this work is achieved. The explorative procedure aims to generate hypotheses and assumptions for further research. Subsequently, after each individual case study, a cross-case analysis according to Yin (2003) is done. It is used to establish a comparison across the case studies in order to achieve a final conclusion regarding the research question. The supporting hypotheses are developed on the basis of the case studies presented. Incorporating the theoretical findings previously elaborated, the theses themselves can already be regarded as findings. The evaluation method according to Habermas (1973), as an emancipatory cognitive interest, is aimed at further developing the theoretical level while the technical interest is based on generating a model on this level.

Thus, in addition to answering the research question, the aim is also to draw a graphic conclusion from the entire collected and analyzed document data. The conclusion is a model design that meets the sustainability criteria from the German-speaking area and is specifically applicable to the health care system.

2.4.1 Analysis matrix

The value-based business model approach of Bieger and Reinhold (2011) serves in the following to picture the five business cases. Table A1 in the Appendix shows the matrix which is used in order to ensure a coherent presentation. The column "Element" I) - VI) shows the business model elements according to Bieger and Reinhold (2011), while the row "Level" a) - c) shows the levels introduced according to Morris et al. (2005). It serves the different levels of strategic decision-making and ensures greater individuality in presentation. The overlaps between the respective elements have already been described and thus legitimize this mix of the two business models.

The *value proposition* is subdivided into A) service and B) customer groups and can be further broken down. Product, product system, assortment, service, integration of the service, integrated project management, emotional profile and customer experience as far as the data material permits this classification (Belz, 1997). Furthermore, the *value creation* is divided into A) resources and B) capabilities; the *value communication and transfer* as presentation consists of A) communication and B) transmission of performance; the *value capture* - of A) customer values and B) company values; the *value dissemination* of A) direct and B) indirect stakeholders in the organization; the *value development* presents the development of the value creation under given and new circumstances. In the business model matrix, each

element of the organizations under review is described on the basis of the available data. On the base of these five matrixes the cross-case analysis is conducted due to the link of both analysis matrixes: the business model and the criteria of sustainability matrix (Table A2 in the Appendix).

2.4.2 Hypotheses

The formulation of hypotheses is carried out in order to support the analysis of the so far scarcely researched field of business models from the health care industry with regard to the sustainability criteria established by the RNE. The working hypotheses, as consistent and unproven assumptions, should serve in this case for the knowledge gain of new observations to modify and improve them. In the qualitative procedure, the hypotheses serve to generate new knowledge and thus contribute to the research discourse (Gläser and Laudel, 2010). The individual hypotheses are developed on the basis of the theory elaborated, the state of research and the sustainability criteria established.

Hypothesis 1: Business models with a sustainable character in the health sector are determined by the strategic orientation of the organization.

Hypothesis 2: Business models from the health sector, which are based on the materiality of sustainability, describe in their value creation concept processes that are decisive for social well-being.

Hypothesis 3: Business models from the e-health sector have the potential to be highly competitive in the healthcare market due to the developing trends.

Hypothesis 4: Sustainably declared business models from the health sector can satisfy people's basic health needs in the best possible way and, conversely, secure their own competitiveness.

Hypothesis 5: Through stakeholder participation, the aspects of sustainability relevant to business models can be pursued and disseminated even more comprehensively and widely.

The following section deals with the implementation of the established constructs, analysis matrixes and hypotheses in relation to the empirical data. Therefore, a diminished overview of the case studies is given.

3 The comparison of the case-studies

3.1 The business models

Case 1:

The Sonormed GmbH (as in 2017) is a medical technology company with their main product Tinnitracks. It is considered as a partially digital treatment (Mey, 2016). Accordingly, this also forms the core of the business model and is the core product in the system. The foundation lies within the e-health sector with the IT-Audio-Health technology app, which is a medical device in the field of digital audiology for tinnitus therapy. The value proposition is shown with the Tinnitracks App, the Tinnimatch App and the Specialist Finder, which accompanies therapy videos and the cooperation with Sennheiser and their headphones in combination with the app. The creation of value through the combination of resources is evident in the business process: 1. diagnosis 2. frequency determination 3. creation of user account 4. addition of the app 5. editing of music (5.1 Optional: purchase of headphones) 6. therapy 7. accompanying videos 8. physician consultation 9. submission of incurred therapy costs to participating health insurance companies. In addition, the application process of the app, which forms the core of the business model, is also listed. The selected channels for value communication and transfer of the service to the customer are web-based channels as well as other communication media. Contact with the target group takes place via user accounts, while for the network, potential doctors can also contact via telephone and e-mail. The val-

ue capture shows that the sale of the product serves as the main source of revenue, and that the financing services of the various funding agencies can also be seen as indirect revenue. The actual dissemination of value takes place in the course of the fact that donor partners receive a high proportion of presentations on the website, thus ensuring continued participation by these stakeholders. The dissemination of the created value does not allow any further conclusions. In this case, the last element of the business model is the value development. It indicates a development that shows the involvement of specialists in the form of ENT physicians as well as a change on the technological level in the way it is used as a form of therapy.

Case 2:

The business model of Medlanes GmbH (as in 2017) consists of the product app medlanes at its core. This app can be used to book home visits, ask questions to doctors, manage one's own medical file and share it with the attending doctor, and, if necessary, to call up and clarify the medical history and any further questions that may arise. With their business model they describe the field of activity of the digital organization of the doctor-patient relationship (Mey, 2016). The managing director and co-founder have laid the foundation in digital business, the e-health sector with a medical product in the form of an online medical platform. The individual value proposition is determined by free access to general practitioners and specialists through online appointment scheduling and the corresponding subsequent home visit by the doctor. The performance of the business model itself is extended by the sending of medication if necessary and a follow-up treatment in the form of a digital meeting. Thanks to an extensive network of doctors, the app now provides its services in 25 cities in Germany. Furthermore, mainly private health insurance companies are involved. To what extent the benefit is refunded to the company in the form of revenue is not evident from the available data. The financing by at least two investors allows an initially guaranteed cash flow. Medlanes creates the intangible value in the form of trust and identification with its verification as a member of the Federal Association for Internet Medicine. The continuous technical development is already determined by the digital environment. On the level of individual character, Medlanes has already made the transition from Berlin to other cities in Germany. Furthermore, the general conditions, the medical legal text, has led them to abandon the originally planned purely digital treatment and to introduce home visits by doctors.

Case 3:

The third case describes the Flying Health Incubator GmbH (as in 2017) as an incubator for healthcare entrepreneurs. They support and accompany start-ups with product and service ideas for digital diagnosis and therapy applications during their foundation and market launch. Flying Health provides the program for start-ups with the objective of a successful market entry. They distinguish between the value creation concept for early- and late-stage start-ups. Further distinction is made between the potential partners who support Flying Health and the start-ups who need support and expertise on a conceptual level. The focus is always on the medical benefit for the patient as an indirect stakeholder group and customers, such as start-ups as the immediate stakeholders. In this way, the value dissemination of the business model is distributed to the stakeholders, whereby the return is negotiated through an individually determined level of participation. The value communication and transfer are not predominantly web-based, but there is rather direct contact in the form of laboratories primarily for the transfer of services for start-ups. In conclusion, it should be noted that this business model is to be understood as a supportive business model in the health care sector, the individual nature of value capture and the dissemination of value remain unclear.

Nevertheless, the core of the business model lies in the digital health sector, the further development and improvement of the existing health care system is equally focused on partners and start-ups.

Case 4:

The core of this business model of DocCheck Medical Services GmbH (as in 2017) is the B2B online platform for medical professionals throughout Europe. It is equipped with different services and focuses on e-marketing, customer relationship management and online market research. This business model follows a business-to-business orientation. The foundation of this business model lies in the e-health sector and serves as an online platform for doctors, pharmacists and medical professionals to exchange information. The individual nature of this element is characterized by the diverse services offered by the platform for a specific customer group. A total of ten different services are offered, including the possibility to ask colleagues (Ask), access to news, short reports, blogs, a medical lexicon, scripts and lectures, certified advanced training (CME) and access to information channels. For each service provided, a DocCheck employee is introduced virally who acts as a contact person and can be contacted via personal e-mail. A pure web-based communication and exchange of propositions as well as access via a user account is guaranteed. There are no external partnerships or alliances identifiable, as the corporate network of the DocCheck AG is already large. The users form their own network as well as the internal number of employees is significantly higher than in the other cases. In return, it is recognizable that access to the community is distributed to third parties in the form of pharmaceutical companies and publishers and that the product system is completed by online advertising, market research, studies and paid content.

Case 5:

The business model of the In good Health academy (as in 2017) is presented as a value proposition. It is located in the e-health sector and is dedicated to direct health care in the form of nutritional advice, ayurvedic teaching and yoga philosophy in individual coaching's, via webinars and online-coaching. According to Ahrend (2016), it is firstly a personal health service, which is intended to work directly with patients, and secondly a non-personal health service, if the services are available online, for example. Thus, it is a hybrid model. The individual characteristic of the performance of this model lies in the courses and the combination of webinars, online yoga training and nutrition coaching as well as the individual development of concepts for yoga studios. The online portal "In good Health Academy" represents the core resource. Together with the qualifications of Dr. med. Scharfenberg it forms the individual nature of the value creation concept. A high proportion is due to external partnerships, which Dr. Scharfenberger uses as a freelance lecturer in institutions to offer and provide her services in the form of workshops, further training, courses and retreats. Web-based media is primarily used as a communication tool and to transfer while a group of customers also experiences direct face-to-face contact. The value development concept is pronounced in the Ayurveda Online Teachings via the Academy, i.e. digitalization is recognized and used as a progressive business field. It is evident that this business model with its fields of activity is the most distant from the traditional healthcare market and has entered the new market niche, the second healthcare market. Well-being and health are the core elements, but the skills and the corresponding offer in this model are based on one persona.

3.2 The cross-case analysis

First, it can be stated that the criteria 1. strategic analysis and measures, 2. materiality, 3. objectives and 4. depth of the value chain cannot be identified as obvious aspects of sustain-

ability in any of the five cases examined. The main criteria of the strategy, which can be expressed primarily at the level of value proposition, but also by all other elements of the business model, are not clearly defined in terms of sustainability aspects. Nevertheless, if one considers the business models and their foundation, all cases are rooted in the e-health sector. This fact combines the two components digitization and health, which are to be understood as important sustainable topics. On the one hand, digitization means the preservation of natural resources. The fact that users usually access services from their homes means that CO_2 emissions are not necessarily increased further.

Another component of digitization is the decline in the use of paper as a natural resource. In the second case, for example, an anamnesis and follow-up treatment is carried out via the app. The online courses in the fifth case also mean that no course scripts have to be printed out, as they are available digitally. The consideration of some ecological components is thus initially guaranteed for all business models. In the form of treatment and care management, the doctor-patient relationship, indirect prevention and healing, and the well-being and fitness aspect, various components of the health market are served. Accordingly, these have the ambition of having a long-term impact on the health of society. The support for start-ups in order to be able to intervene sustainably in these components is both economic and a decision for the development of the health care for the society. An online platform for actors in the health care system only works when the intention to network and to share ideas is strikingly the same and when it is supported by the thought of ultimately being able to help other people and profit economically from it. Also, the last business model contributes to one's own well-being and that of others through its service and ultimately ensures that long-term health is cultivated. These aspects can be derived as the main objectives of the sustainability concept in the e-health sector for strategic orientation.

The criteria regarding process management can also be regarded as very homogeneous in comparison. In all cases, responsibility is assigned to the management, which is understood in the business model as a resource, since knowledge is accumulated here and carried top-down through the company. Based on the given resources, appropriate skills can be developed. The handling of rules and processes cannot be presented due to the lack of an internal view of all five business models. In the form of guidelines, information boards and other media up to working groups, the design of this criterion for the topic of sustainability can take shape. For the business model, this would be particularly important with regard to rules for suppliers, partners and financiers.

The criteria on innovation and product management must be linked to element VI), the value development, in all considered cases. It can be seen that through constant development and improvement, the e-health concept contributes to the fact that innovation is a permanent task, also due to the rapid technological innovations. In this context, sustainability is ensured in a general sense by the health orientation and in an economic sense.

The environmental criteria relating to the use of natural resources, resource management and climate-relevant emissions are again applied equally to the value creation concept for all five case studies. Above all, the consumption of natural resources is at least not increased by the digital aspect; there is a lack of insight into resource management and climate-relevant emissions.

In the case of the society criteria, no valid statement can be made about labor rights, human rights and political influence. In the fourth case, a statement on equal opportunities can only be made in the form of addressing future employees. The atmospheric working environment with an open culture is used to ensure a steady flow of new knowledge, manpower and

corresponding skills. As a training criterion, the DNA Career Laboratory is used to ensure the importance of the qualification of its own employees. Furthermore, case five can be mentioned in the sense of the qualification of the performance creation process, in which yoga teachers receive further training.

Finally, the law and directive-compliant behavior is mentioned, which is only followed by case two in the sense of the fulfilment of the standards of the Federal Association for Internet Medicine. In the third case it can be assumed, as one of the managing directors is a member of the board of directors of this association. However, only assumptions and no concrete statements can be made.

In summary, it can be said that a very homogeneous picture of business models in terms of sustainability has emerged. The prerequisites in the strategic sense are met in all the cases examined, the obvious integration of the sustainability aspects considered as important in each case must then follow. This is done on an internal company level by defining sustainability goals, thinking through and checking the integration of the entire value creation process and then implementing it.

4 Discussion

It can be stated that the business models described in the e-health sector are, due to the nature of the industry, first of all per se socially sustainable and positioned in favor of sustainable development, which benefits society on the one hand and in return also the competitiveness of the company.

The four criteria of the DNK's strategy show that all cases have the potential to further develop explicit sustainability strategies owing to the combination of digitalization and health. In addition, the services and products are aimed at maintaining health, which can be claimed to be fundamentally sustainable for society. A special market niche then makes up the individual company concept. Partnerships and financing are decisive for the competitiveness and thus the longevity of the organization. Furthermore, both personal and non-personal health services also work as perspectives.

In process management, the observation of rules and processes as well as their control is difficult and would have to be reassessed by a different perspective. The role of partners and alliances has proved to be important and essential in all cases. It should be further emphasized as an element in combination with the health sector's own sustainability strategies. For example, in the sense of core partnerships, which are crucial to the business process.

The strategy and its responsibility should be highlighted as the most essential aspect. If sustainability is anchored in the strategy, then it is also reflected in the business model. If the business model is viewed as a blueprint (Osterwalder et al., 2005), it can function as a simplified representation and communication medium for sustainability, and must be integrated into it by means of specific criteria. In this way it can be shown how a conceptual model can be created from the corporate strategies.

4.1 The new approach

Ahrend's (2016) research regarding sustainable business models is now used to be combined with the gained knowledge from the case studies to propose a sustainable business model approach for the life science sector (Table 3). It follows the business model canvas approach (Osterwalder and Pigneur, 2011), takes the value -based approach (Bieger and Reinhold, 2011) into account and serves as an exemplary concept in the development of new business models.

The own presentation of the understanding of sustainability in the health sector and the social objectives that should be pursued are: long-term, holistic, patient well-being, health, quality of life, mandatory health care, reduction of threats and risks to human health.

Table 3 Sustainable business model matrix for the health sector (own representation).

Business model elements	Sustainability components
1. Key activities	1. Trend analysis, definition of objectives, level, use
1.1 Field of action	- Contributions to environmental protection
1.2 Target group	- Low resource consumption, digitalization
	- Responsibilities, corporate management and strategy
	1.1 Create long-term social and health benefits
	1.2 Improve ecological footprint of the customer
2. Key partners	- Alliances with health insurance companies and doctors
	- Investors and supporters
3. Key resources	- Technical equipment
	- Experience and skills
4. Customer relations and channels	- Quality seal, e.g. Federal Association for Internet Medicine
	- Building trust through communication and accessibility
	- Digitization
5. Development and innovation	- Innovation circle
	- Trend development
	- Prizes and honourings
6. Revenues, costs and dissemination	- Sustainable value creation
	- Revenue models and sources of income
	- Research and development costs
	- Participation in achieved sustainability goals
7. Employees	- Qualifications
	- Employee rights
	- Standards
	- Trainings
	- Incentive systems
8. Society, laws and directives	- Social engagement, human rights
	- Consideration of current political situations
	- Verbalization of internal rules, processes and control
	- Sustainability standards (DIN ISO 26000)

The model and the sustainability criteria in the health sector should be based on it in order to ensure a holistic approach and to use sustainability criteria in a meaningful way. The own competitiveness as an economic component is relevant to assure the fulfilment of social objectives. Furthermore, the ecological component in the form of resource protection must be taken into account in every process and the management must ensure that this component has the highest priority in its relations with all stakeholders.

Whether describing or developing a business model, it is important that the individual elements of the business model are specified (Ahrend, 2016).

The identified important elements for a business model in the healthcare sector consist of the elements 1.-8. in Table 3. The corporate strategy is synchronized with the strategies of sustainability and how this is understood in the company. The strategies of sustainability are represented by the explicitly formulated components, as expressed in the second column of Table 3. In each element of the business model, the proposed corresponding aspects of sustainability must be taken into account and corporate management must consider the extent to which its own organization emphasizes various aspects and may neglect or even add others, depending on the given priorities. The process model presented by Granig and Lingenhel (2016) can serve as a template for developing one' s own business model. Figure A1 [cf. Appendix] shows the findings of Table 3 in a compromised form and might be used for first drafts.

5 Conclusion

The following mentioned hypotheses and their explanations represent a summary of the results of this article. They can also be used to serve as a reference understanding for further research in this discourse.

H1: *Business models with a sustainable character in the health sector are determined by the strategic orientation of the organization.*

The strategic orientation and thus the basic decisions for the further development of the business model determine whether there is a strategy for sustainability or not. Starting with the Executive Board as the responsible person for implementing the subject, the components and criteria are then distributed and applied to the various elements and levels of the business model (see additionally Lüdeke-Freund, 2017).

H2: *Business models from the health sector, which are based on the materiality of sustainability, describe in their value creation concept processes that are decisive for social well-being.*

Due to the general orientation of the companies, their fields of activity and their value proposition, the objective can be determined by mapping the entrepreneurial action. In each of the cases, the combination of resources and skills is designed to strengthen and increase social well-being through the help of therapy, support for doctor-patient communication, support for the development of therapy and prevention products, a medical platform and health coaching.

H3: *Business models from the e-health sector have the potential to be highly competitive in the healthcare market due to the developing trends.*

As a result of social developments and the constant evolution of technology and technical standards it can be said that there is a high potential. Due to the ever-increasing awareness of environmental protection in the course of the ongoing climate debate, the growth of the e-health sector has demonstrated that the potential in this segment has not yet been fully exploited. In particular start-ups with their dynamism and competitive intensity can exploit their potential for the healthcare market even further here.

H4: *Sustainably declared business models from the health sector can satisfy people's basic health needs in the best possible way and, conversely, secure their own competitiveness.*

The connection with regard to social and economic dimensions and the connection of the balance of interests is fulfilled by the business models in the health sector described. The necessary measurement to show the actual share of sustainability in this fact is missing due to the chosen research strategy and the limitation of the possible measurement concepts. Nevertheless, it can be said that social sustainability in the health sector is taken into account above all and that there is a corresponding relationship.

H5: *Through stakeholder participation, the aspects of sustainability relevant to business models can be pursued and disseminated even more comprehensively and widely.*

The size, the number of employees and the economic efficiency of the organization are decisive. Here, manpower is defined and accordingly the workload, which has a decisive influence on corporate activity. The intervals at which offers, products or services can be expected and how comprehensive these can be also depend on the number of employees. In the cases considered, this means that small organizations in particular have many cooperation's and partnerships externally, which naturally also spreads the influence of sustainability. Through the network, a larger circle of indirect stakeholder groups also experience the relevant aspects, provided that these are consciously lived as rules, anchored in the strategy.

6 Limitations and further research

There are limitations regarding the chosen model and theory. Yin (2003) uses the four criteria of internal and external validity, reliability and objectivity for the evaluation of qualitative case studies. Regarding objectivity, this is permanently given by the external company view in form of a mere document analysis. Hence, reliability is partly proven as the consideration of the different business cases under the given theoretical approaches in the same investigation steps should lead to the same results. The internal validity is ensured by the establishment of the hypotheses, the presentation of the relationships in the cross-case analysis and the final consolidation in a separate presentation that documents the consolidation of the observed events. The generalizability of the research results in relation to the entire health care sector and thus an external validity is more difficult to confirm due to the limitations of the model and the theory. The value orientation of the value-based business model approach leads to a certain homogeneity in the case studies due to its economic orientation. For a valid external validity, further empirical analysis material needs to be collected in order to ensure meaningful and generalizable findings under a greater heterogeneity. Nevertheless, the general bias of this methodology is enormous. In this article especially the researcher or observer bias is worth mentioning since there were no other instances involved in the writing process but the supervisor. For this, it is important to constantly confront prejudices with the gathered data to avoid subjectivity. Further, the criteria model of the DNK was originally designed to serve as an information and communication instrument for internal reporting within the company. The criteria model could be investigated in further research within organizations to confirm the suitability of the criteria. Therefore, Interviews with the corporate management and responsible persons from the strategic management are suggested for further research. In the theoretical construct of strong sustainability it has been shown that there was no relevance for the component of culture for this research in life science and therefore replacing the dimension with the element "health" could be considered. A further research approach could also be the classification of start-ups after their fields of action and the

comparison of each field and the belonging business models regarding sustainability to gain a wider understanding of the industry.

The potential in the healthcare sector is enormous. This specific, dynamic and fast-growing field of research has given rise to a further approach for the design of business models in the health sector. The e-health sector and the e-business typologies provide a decisive outlook on the opportunities that this sector contains. Further research projects can be taken up for this purpose.

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Appendix

Table A1 Business model matrix (own representation).

Level	a) Foundation	b) Individual character	c) Rules	No.
Element				
I) Value proposition – divided in A) services and B) customer groups (product, product system, assortment, service, integration of the service, integrated project management, emotional profile and customer experience				
II) Value creation – integration of A) resources and B) capabilities				
III) Value communication and transfer as presentation - consists of A) communication and B) transmission of performance				
IV) Value capture - A) customer values and B) company values				
V) Value dissemination - of A) direct and B) indirect stakeholders in the organisation				
VI) Value development - the development of the value creation				

Figure A1 Sustainable business model draft (own representation).

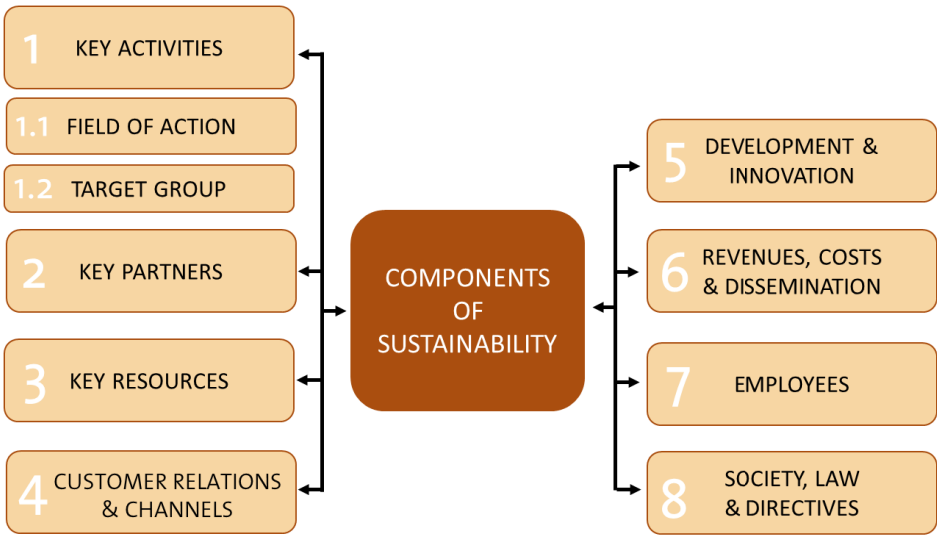

Table A2 Cross-case analysis matrix (own representation).

Criteria of the German Sustainability Code		Sonormed GmbH	Medlanes GmbH	Flying Health Incubator GmbH	DocCheck Medical Services GmbH	In good Health
Strategy	**1. Strategic analysis and measures**	I-VI), a-b) key activities: no explicit reference	I-VI), a-b) key activities: no explicit reference	I-VI), a-b) key activities: no explicit reference	I-VI), a-b) key activities: no explicit reference	I-VI), a-b) key activities: no explicit reference
	2. Materiality	I, II a-b) no specific reference identifiable	I, II a-b) no specific reference identifiable	I, II a-b) no specific reference identifiable	I, II a-b) no specific reference identifiable	I, II a-b) no specific reference identifiable
	3. Objectives	I-VI a-b) no explicit objectives are declared	I-VI a-b) no explicit objectives are declared	I-VI a-b) no explicit objectives are declared	I-VI a-b) no explicit objectives are declared	I-VI a-b) no explicit objectives are declared
	4. Depth of the value chain	II b) internal and external value creation	II b) internal and external value creation	II b) value creation in terms of start-up support / Incubator	I, II b) online services	I, II b) online services / face-to-face
Process management	**5. Responsibility**	II b) with the three managing directors	II b) with both managing directors	II b) with both managing directors	II b) no explicit reference	II b) treating and executing doctor
	6. Rules and processes	c) no internal view accessible	c) no internal view accessible	c) no internal view accessible	c) no internal view accessible	c) no internal view accessible
	7. Control	no internal view accessible	no internal view accessible	no internal view accessible	no internal view accessible	no internal view accessible
	8. Incentive systems	V) no explicit reference	V) no explicit reference	V) no explicit reference	V) no explicit reference	V) no explicit reference
	9. Stakeholder participation	V) no explicit reference	V) no explicit reference	II), V) no explicit reference	II), V) no explicit reference	II), V) yoga studios
	10. Innovation- and product management	I) VI) development concept in the technological sense	I) VI) continuous technical development	I), VI) continuous technical development	I), VI) continuous technical development	I), VI) first online training
Environment	**11. Use of natural resources**	II) preferably none	II) if possible none	II) little	II) little	II) little
	12. Resource management	II) no explicit reference	II) no explicit reference	II) not recognizable	II) no explicit reference	II) no explicit reference
	13. Climate relevant emission	II) no explicit reference	II) no explicit reference	II) no explicit reference	II) no explicit reference	II) no explicit reference
Society	**14. Employee rights**	no explicit reference	no explicit reference	no explicit reference	no explicit reference	no explicit reference
	15. Equal rights	no explicit reference	no explicit reference	VI) no explicit reference	VI) DNA Career laboratory	VI b) no explicit reference
	16. Training	no explicit reference	no explicit reference	VI) no explicit reference	VI) DNA Career laboratory, I b) CME	I b) external
	17. Human rights	no explicit reference	no explicit reference	no explicit reference	no explicit reference	no explicit reference
	18. Community	II b) partnerships and alliances	II, VI b) partnerships and alliances in 24 cities in Germany	II b) partnerships with 9 industrial organizations	I b), VI b) job market, DNA Career laboratory	I b), VI b) partnerships
	19. Political influence	no explicit reference	no explicit reference	no explicit reference	no explicit reference	no explicit reference
	20. Law & directive-compliant behaviour	II b) partnerships and alliances	V b) member of the Federal Association for Internet Medicine	II) board of directors of the Federal Association for Internet Medicine	V) no explicit reference	no explicit reference

