GREEN BUSINESS MODEL INNOVATION: ENHANCING BUSINESS PROCESSES THROUGH APPLICATION OF ARTIFICIAL INTELLIGENCE IN ORDER TO REDUCE THE ECOLOGICAL FOOTPRINT

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Abstract
Business Model Innovation today is mostly driven through software-based solutions which are used to digitize business processes, mostly leading towards a digital transformation of an enterprise. That transforms the existing business models either in incremental steps or in a radical way by creating and introducing entirely new value propositions to business concepts. Whilst entrepreneurship has the target to maximize margins, the ecological footprint often is not considered in the focus of business strategies.
The only restrictions in terms of sustainability the majority of companies comply with are those given through regulations by the government in order to be compliant under the terms of corporate social responsibility. The barriers corporations are facing in the attempt to transform their business into a green business model has several occasions, essentially it is the trepidation of financial effort to transform the existing business models into green ones. Furthermore, there is a shortage of knowledge, awareness and skills within the entire value chain of companies to implement green business models (Bisgaard, T. et al., 2012).
The approach to improve the ecological footprint of business processes is still not exhausted and explored in the industry yet. The approach to establish an eco-friendly business is still overruled by the greed for profits of the shareholders. The authors of this paper will use a descriptive research method and an inductive approach to investigate and present the contribution of artificial intelligence on the innovation of green business models and their impacts on sustainable business processes and operations.

Keywords
Green Business Model Innovation, Artificial Intelligence, Sustainability, Business Processes.

JEL Classification
M14, M21, O31

Introduction

There are a lot of discussions in public and debates of scientists dealing with the challenge of companies to create sustainable business in order to diminish the environmental pollution risks of business operations. All approaches and concepts of companies emphasize on the importance of using sustainable resources to manage the reduction of the ecological

footprint. This pertains not only to the manufacturing industry but also to other industrial sectors, the stakeholders and shareholders as sustainable business always includes the entire value chains.

While the shareholders of companies attempt to increase their profits, environmental managers focus on the compliance with current environmental regulations, customers are pushing companies to produce or sell sustainable products or services due to an increased awareness towards sustainability and in the same time are willing to pay for those higher prices (Clarke et al., 1994).

In the middle of this area of conflicts, entrepreneurs have to decide on which of those impulses they base or transform their business model upon. Still there is a common prejudice that complying with environmental stipulations or any other law usually is not resulting in a positive financial return (Osterwalder and Pigneur, 2010). Contrary the broad major opinion of entrepreneurs, transforming the business into a green business model can precede to financial, environmental and innovation results. (Bisgaard et al., 2012).

Furthermore, companies have the potential to differentiate their products or services from their competitors being more sustainable and greener than their competitors. Besides that, alternative resources for materials are sought due to increasing costs and supply risks for material that have scarce resources. (Bisgaard et al., 2012).

Additionally, to adapting the existing business model, corporations can implement new technologies such as artificial intelligence into their business operations with the target to improve the business processes and reduce the ecological footprint whilst capturing the economic value in a life-cycle perspective (Toma & Naruo, 2017).

The main concepts of the paper are green business model innovation and artificial intelligence and contains the investigation on how to improve business processes in combination of both. The term green business model innovation has so far, no established internationally acknowledged definition. Focusing on the term business model innovation, the most valid academic contributions are publications by Osterwalder, Chesbrough, Gassmann and Ries. According to Osterwalder et al. a business model depicts the structure a corporation creates, delivers and captures value (Osterwalder et al, 2014). The green approach into the business model innovation is a game-changer for the redefinition of old industries and the creation of new industries, where the cornerstones are business, technology and environment (Mandapaty and Mc Clure, 2016). The term artificial intelligence has been defined in different ways. For the purpose of that paper, artificial intelligence is defined as the skill of a digital computer or robot, that executes tasks in conjunction with human beings, with the difference of having the capability to process large volume of data, recognize patterns and learn by higher extend then humans. (Marr, 2018 and Akerkar, 2019). Organizational changes through usage of artificial intelligence is the most successful in the following areas, such as human interaction, situational analysis, support in the decision-making process and the prediction of forecasts (Bitkom and Dfki, 2017).

Research methodology

The authors used a descriptive research method to achieve their research objective. Information was gathered from numerous sources of secondary literature, mainly specialist books and articles from the domain of information technology, management and innovation or publications in the field of green strategy, focusing on green business model innovation and the challenges and approaches companies already deducted. Furthermore, an inductive approach is chosen to draw a conclusion on the effects artificial intelligence executes upon business processes inducing towards a green business model innovation.

Influence of Artificial intelligence on business processes

Elaine Rich already defined in the year 1983 a very elegant definition of artificial intelligence as "artificial intelligence is the study of how to make computers do things at which, at the moment, people are better." (Rich, 1983). Artificial intelligence developed to a great extend since then through scientific research and is gradually implemented in many business processes to support and enhance business operations. In this paper, it is solely focused on the integration of artificial intelligence into business processes of procurement, production and after sales service. The available functions of artificial intelligence are described in the following to establish an understanding for possible scenarios of dedication.

Surveillance: The strength of intelligent systems is the continuous surveillance and examination of big data. Through pattern recognition deviations or anomalies can be detected in real-time and corresponding measures can be initiated right away (Castro and New, 2016).

Recognition: By simultaneous processing of data which receive the application either of sensors or use big data of other processes, precious information could be retrieved. This is better known as data mining, using algorithms to automatically extract empiric correlations between different objects of data bases (Gentsch, 2018).

Predict: An application of artificial intelligence is not able to predict and foresee the future when initially practiced, usually those are based on findings of the past and especially on the quantity and quality of the historic data available. The competitive edge to conventional methods is the capability to process big data in minimal time and autonomously draw conclusions. Through continuous learning of big data, the prognosis improves continuously.

Interpretation: Compared to traditional data analysis methods processing mainly structured data sets, artificial intelligence enables -due to the learning aptitude and pattern recognition- the interpretation of severe classifiable unstructured data sets and signals such as pictures, videos, audio and text data (Castro and New, 2016).

Interaction: This function allows systems to be fully automatized with respect to interactions between the physical environment, with machines and humans. The use of sensors and cameras allow robots to interactively percept their environment, utilize voice and gestures in combination with extraction of big data to communicate with machines, humans or among themselves.

Given the functions of artificial intelligence, their influence on business processes in the selected divisions procurement, production and after sales service are investigated.

Procurement: The general task of procurement is to purchase goods and material in a cost-efficient and accurately timed for the further processing in the value chain of a company. Normally, the purchasing process is drained in a specified procedure with given values as delivery time, best price and others. By implementing artificial intelligence, especially the functions of interpretation and interaction, are applied and maintaining the access to the connected data bases, the artificial intelligence assigns the required products to the appropriate suppliers to request an offer. After receiving the quotes, the artificial intelligence chooses for the best one according the predefined attributes and donates the order to the supplier, informs the initiator and surveils the delivery time. With all these collected data, a supplier ranking can be generated and utilized for future tenders.

In summary, the artificial intelligence adopts most of the routine work in procurement and enables the employees to concentrate on other tasks.

Production: In the production process goods have to be produced in time, economically priced and in highest quality in order to be competitive globally. In order to reduce high costs of machine breakdowns, artificial intelligence fosters predictive maintenance applications by retrieving all the necessary data of the machine sensors and hence calculates the next maintenance date. With these data and information, the maintenance deficiencies can be diminished and protect against major damages (Bitkom and Dfki, 2017). In

production, the functions surveillance and prediction of artificial intelligence are applied, as data has to be surveilled continuously and historical data has to be evaluated to establish a correct maintenance prognosis.
After Sales Service: Furthermore, the monitoring of big facilities (for example wind power plants or oil-rigs) is time consuming and cost-intensive. The exertion of drones with cognitive abilities, for example, renders records of the relevant components and sends them to a central artificial intelligence to evaluate the data. The surveillance of the facilities thereby occurs continuously and in the same time avoids cost-intensive machine failures (BITKOM, DFKI, 2017). It also reduces the insertion of service technicians to travel to those locations which is saving travel times, that means less costs for the vendor of the machine but also at the same reduced environmental demise.
The examples above demonstrate, that the application of artificial intelligence substitutes human tasks where reasonable in a more efficient, failure-free modality. Still, the human interference in important decisions and processes on the merits of the case will not be eliminated.

Green Business Model Innovation: incentive models and life-cycle models
According the definition of Gassmann et al., business model innovation implies the modification of at least two of the four core elements - value creation, customer offering, customer segment, revenue stream - of the existing business model (Gassmann et al., 2013). Corporations are constantly striving to change their existing business models to keep up with their global competitors due to the new upcoming, mainly digital technologies. Besides, companies are increasingly confronted by the stakeholders with the requirement to actively adopt and comply with the corporate social responsibility (Schneider and Schmidpeter, 2012). The corporate social responsibility in this particular case is highlighting on the ecological perspective of sustainability only and goes beyond the legal compliance onto a proactive commitment under public surveillance by the society, customers and competitors (Schneider and Schmidpeter, 2012). That is the driver for entrepreneurs to green their business models by adapting their products, internal processes, services or change their whole value chain with the purpose to differentiate from their competitors. Especially the customers' demand for sustainable products and services as well as their disposition to pay for those requirements and the increasing costs of resources leads corporations to consider creating a green business model (Bisgaard et al, 2012).
In this paper the definition of green business model innovation is understood as an enterprise changing parts of their business model with the target to capture the economic value whilst reducing the ecological footprint in a life-cycle perspective (Bisgaard et al., 2012). The clustering of green business model innovation is categorized between incentive and life-cycle models. Incentive models are business models where the ownership of a product or its functionality is kept and paid by their owners but are incentivized by their customers for a green value chain of production, maintenance or disposal (Bisgaard et al., 2012). Life-cycle models are zooming on greening the entire value chain within a life-cycle perspective. (Bisgaard et al., 2012).
The incentive models are briefly explained in the following section.
Functional sales: In this business model the service provider inherits the supervision of a products use-phase, receiving incentives in case the product performance and durability is increased, maintenance and repair is reduced and the energy-efficiency improved whereas the ownership of the physical product persists with the provider (Erek, 2019).
Energy Saving companies (ESCO): The provider of the business model of ESCO takes over business operations or the facilities of corporations and is paid according the achievements in energy savings – it is a win-win situation for the customer who remunerates less if the

consumption is fewer and gets compensated if the savings are less than contractually agreed upon (Bisgaard et al., 2012).
Chemical Management Services (CMS): CMS is the contractual engagement of a supplier as a strategic partner (long-term) who earns profits through the management of chemicals combined with a related service by minimizing the consumption of chemicals, which leads to more sustainability in the production processes of the customer (Fora, 2010).
Design, Build, Finance, Operate: This business model is a green operating model or public-private partnership (PPP) based on a long-term contracts in order to decrease life-cycle costs, especially applied in the construction business.
The life-cycle models are summarized in the following section.
Green Supply Chain Management (GSCM): The target of GSCM is to degrade toxic materials and purchase products in the most sustainable way possible within the supply chain in order to meet the increasing demands for environmentally sustainable comportments (Fora, 2010).
Take Back Management (TBM): Producers find cost-effective ways to recover products from their customers or suppliers by taking over responsibility for waste management through take back mechanisms of the downstream use of their products (Bisgaard et al.,2012).
Cradle to cradle (C2C): In this business model, the responsibility of suppliers for their products goes beyond the usage of it, where the incentive of designing and producing products lies in the reusage of components as technical or biological nutrients. (Fora, 2010).
Industrial symbiosis (IS): This systems approach is tagging on business opportunities to leverage idle resources towards a greater extend in sustainability with the target of cost reduction within the circle of participating companies by shared utilization of resources (Lombardy and Layboum, 2012).

Enhancing Green Business Models by application of Artificial Intelligence

The enhancement of innovative green business models through the application of the functions of artificial intelligence are investigated on two exemplary, selected green business model innovations, functional sales and green supply chain management.
In functional sales the service provider is contracted with the supervision of a product and earns profits by sustainable performance during the use-phase. The functions prediction and surveillance of artificial intelligence enhance the targets of the green business model functional sales by the extraction and evaluation of big data gaining deeper and faster insights on the status quo of the products in use. Thereby, the service provider can rely on professional predictions and historical data gained by artificial intelligence and reaches both targets, firstly, increasing the overall performance of the products in the use-phase in order to be incentivized and secondly the purpose of his business model to be green.
Green supply chain management is implemented to create a green supply chain to diminish harmful components in products as well increasing the ecological footprint. By implementation of artificial intelligence into green supply chain management, the functions interpretation, interaction and surveillance complement the aims of the business model. With set parameters the artificial intelligence helps to process enormous amount of data in fewest time, recognizes certain patterns and draws conclusions autonomously. The supply chain is optimized and speeds up the response times within the different process steps through communication, analysis and prognosis in real-time.

Conclusions

Green business model innovation and artificial intelligence are complementary to achieve the purpose of creating sustainable business processes to a higher extend than conventional green business models. By implementing green business model innovation in combination

with artificial intelligence, corporations inaugurate new markets and strengthen their global competitiveness due to higher entry barriers. Furthermore, it is a reasonable approach to respond to the increasing demands of customers and other stakeholders towards sustainability. The challenge for entrepreneurs is to fully understand the diverse potential of the functions of artificial intelligence to support a green business model and learn how to implement them in their business operations.

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