How smart technologies can support sustainable business models: Insights from an air navigation service provider

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Abstract

Purpose

Although research on smart technologies explains their critical importance in sustainable business models (SBMs) (Mikalef *et al*., 2017), it remains unclear how organisations can embrace smart technologies to create and/or improve their sustainable business models. The purpose of this paper is to unravel and address the challenges of smart technologies to build and maintain a sustainable business model for organisations.

Design/methodology/approach

The research develops an empirical analysis through a case study approach. We have investigated the case of ENAV – an Italian air navigation service provider – and how this firm uses smart technologies in the creation of its successful SBM. After constructing a basic theory, the authors moved to evidence collection. The data analysis has adopted a qualitative approach based on a thematic analysis of the transcripts and related documents.

Findings

The findings from the case study support the idea that the business value and the strategic relevance of smart technologies still remain largely underestimated in SBM adoption (Mikalef *et al*., 2017). Case study findings suggest that, until today, smart technologies have played a minimal role in SBM adoption. However, the smart technologies show the potential to inform the SBM adoption process by contributing to corporate communication for external stakeholders and to the main dimensions of SBMs such as safety and security or the respect for social and environmental criteria in the supply chain.

Practical implications

This study seeks to support organisations and their directors to build and improve sustainable business models through smart technologies to maintain their competitive advantages. Specifically, our findings suggest that smart technologies can help organisations bridge the design-implementation gap of sustainable business models.

Originality/value

This research advances our understanding of the role of smart technologies by explaining how they can enhance sustainable business model adoption. Indeed, we offer a comprehensive view of the integration of insights from three different but related literature streams such as sustainability strategies, smart technologies and change management studies.

Keywords: Smart Technologies, Sustainable Business Model, Change Management, Case Study.

1. Introduction

Smart technologies are critical to every organisation. As a consequence, there has been great hype that has led organisations to make considerable investments to explore how they can use smart technologies to build or improve their sustainable business models (Pan *et al*., 2018). Smart technologies is an umbrella term that encompasses all of those technological innovations, such as the Internet of Things, big data analytics, blockchain and artificial Intelligence, that have an impact on sustainability in organisations (Lee, 2012). Consistent with the concept of corporate sustainability such as the integration of social, ethical and ecological aspects into business operations and decision-making (Van Marrewijk, M., 2003), sustainable business models (SBMs) become increasingly vital in such a smart technology context because corporations should incorporate sustainable values that reflect economic, social and environmental benefits (Evans *et al*., 2017).

Previous research (Garzella and Fiorentino, 2014) points out that the process of SBM creation should entail four dimensions, i.e., what, why, when and how. Organisations should, first, identify what types of SBMs to seek to develop ("what"), which should be related to their corporate values ("why"). SBMs need to balance short- and long-term company objectives ("when") where organisations should choose the best way to implement such business models ("how"). Smart technologies contribute to the design and implementation of SBMs (Yang *et al*., 2017) by accelerating or improving the process of SBM creation. Other studies (Kotter, 2006; Schein, 2010) suggest that the process of SBM creation encompasses eight phases and three related strategies. The first three phases, i.e., generating a sense of urgency, forming coalitions and creating a corporate vision, create motivation for organisations to change, i.e., an unfreezing strategy. The following three phases, i.e., communicating the vision, empowering others and planning short-term goals, allow organisations to learn new concepts and make sustainable changes, i.e., the change strategy. Finally, the organisation should consolidate and institutionalise the new changes, i.e., the refreezing strategy.

The process through which SBMs are created and developed is well-consolidated in literature (Evans *et al*., 2017); however, the role of smart technologies in such a process remains unclear because integrating smart technologies in SBMs is complex (Hart *et al*., 2003; Zott *et al*., 2011). Despite the growing relevance of smart technologies in SBMs (Wu *et al*., 2018), the role of SBMs still needs better clarification and empirical evidence to develop a complete and univocal SBM theory. Although research on smart technologies explains their critical importance in SBMs (Mikalef *et al*., 2017), it remains unclear how organisations can embrace smart technologies to create and/or improve their sustainable business models. This research aims to unravel and address these challenges of smart technologies to build and maintain a sustainable business model in organisations. Therefore, we contribute to overcome at least two of the three substantial research gaps highlighted in the call for papers when arguing that there is a "limited understanding of how organisations need to change to embrace technological innovations", and "prospective implications of smart technologies for SBM development is largely an unexplored area".

We seek to address this research gap by empirically assessing through a case study approach how ENAV – an Italian air navigation service provider – uses smart technologies in the creation of its successful SBM. We had access to the main actors, i.e., directors, accountable for smart technologies and the SBM for ENAV. We enriched our dataset with publicly available interviews and a wide range of documents, reports and videos, which were analysed by adopting a blend of inductive and deductive approaches (Graebener *et al*., 2012). The case study method is particularly suitable to address our

research objective because it allows for conducting an in-depth and exploratory analysis of smart technologies phenomena in relation to a specific environment (Yin, 2016).
The paper is structured as follows. The next section presents an overview of extant research on smart technologies and SBMs, followed by a description of the case study and our robust methodological approach. The last two sections unravel, respectively, our findings and discussion, and conclusion and contribution to theory and practice.

2. Literature Review

Based on the potential benefits for firms and societies, sustainable business models (SBMs) are increasingly becoming a relevant topic in the agenda of executives, managers and scholars (Choi and Wang, 2009; Lamboglia *et al*., 2018; Schaltegger *et al*., 2016). Furthermore, relevant trends, such as smart technologies (Fitzgerald *et al*., 2013; Loebbecke and Picot, 2015; Roden *et al*., 2017), are pushing firms towards the use of new business models (Cohen and Kietzmann, 2014; Fjeldstad and Snow, 2018; Holweg and Helo, 2014). Thus, we reviewed previous studies on SBMs, smart technologies, SBM adoption, and the role of smart technologies in the SBM adoption process.

Sustainable business models

Sustainable development, defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987), informs the concept of sustainable business models. A sustainable business model is developed when firms, recognising the importance of moral and ethical values, integrate aspects of corporate social responsibility into their business models (Banerjee, 2002; Epstein and Roy, 2001; Galbreath, 2009; Galeotti and Garzella, 2013; Elkington, 1997).

Sustainable business models overcome the business model concept by incorporating sustainability concepts, principles, or goals and by integrating sustainability into their value propositions, value creation and delivery activities, and/or value capture mechanisms (Geissdoerfer *et al*., 2018). SBMs include many types of business models such as the so-called social enterprises (Defourny and Nyssens, 2010) or circular business models (Bocken *et al*., 2016). The many types of SBMs are characterised by five common features: "1. Sustainable value incorporates economic, social and environmental benefits conceptualised as value forms. 2. Sustainable business models require a system of sustainable value flows among multiple stakeholders including the natural environment and society as primary stakeholders. 3. Sustainable business models require a value network with a new purpose, design and governance. 4. Sustainable business models require a systemic consideration of stakeholder interests and responsibilities for mutual value creation. 5. Internalising externalities through product-service systems enables innovation towards sustainable business models" (Evans *et al*., 2017, p. 5). These features have also been investigated in the aviation industry by analysing how to support companies in formulating and implementing strategies for sustainability (e.g., Amaeshi and Crane, 2006; McManners, 2016). However, despite their growing relevance, the concept of SBMs still needs better clarification and empirical evidence to develop a complete and univocal SBM theory. Many SBMs fail with severe economic implications for companies and considerable delays in the adoption of sustainable solutions (Geissdoerfer *et al*., 2017). Evans *et al*. (2017) summarise the main reasons found in the literature: the lack of balance among co-creation of profits and social and environmental benefits; the prevalence of business rules, guidelines, behavioural norms and performance metrics inhibiting the introduction of new business models; the reluctance to allocate and reconfigure resources to sustainable

business models; the complexity of integrating sustainability and business model innovation; the relevant efforts needed in the interaction with external stakeholders; and the difficulties related to the fact that existing business modelling methods and tools are few and rarely sustainability driven. The success or failure of SBMs is also related to the way sustainable business models are realised. Although research shows that the adoption process is essential for the success or failure of SBMs (e.g., Stål and Corvellec, 2018), there is a lack of studies on this topic. Moreover, the role of smart technologies in the SBM adoption process remains relatively unexplored (Wu *et al*., 2018). However, among a wide range of SBM approaches (Dentchev *et al*., 2018), the "technology-based approach" should offer the favourite lenses to analyse the relationships between smart technologies and SBMs as it studies the SBM development concerning new smart technologies (Foss and Saebi, 2017).

Smart technologies

Smart technologies refer to all those networks of smart or intelligent objects and devices that enable corporate actors to make rapid yet accurate decisions in response to the changing environment (Pan *et al*., 2018; Lee, 2012)[1]. Smart technologies include a wide range of automated systems equipped with automatic data exchange and technology capabilities characterised by "self-monitoring, analysis and reporting technology (SMART)" (Mashhadi *et al.,* 2018 p.1108). They pervade every business operation and characterise most of the organisations and are widely used in a number of sectors, including manufacturing and aviation. For instance, smart technologies in the aviation industry are not only desirable but also a necessity. The aviation industry mainly aims for more sophisticated smart technologies that will result in fewer errors and ultimately improve the economy of the industry with being the safest and the most efficient mode of transport (Raju *et al.*, 2019).

The primary purposes of the smart technologies – for instance, in the manufacturing and aviation sector – is to enhance competitiveness amongst businesses, reduce costs, maximise profits and ultimately create a sustainable business model (Maurino *et al.*, 2016). The 4th Industrial Revolution (Industry 4.0), which integrates all the current smart technologies, is the cornerstone for implementing new business models through technologies (Lu and Weng, 2018; Rantala *et al.*, 2018). Previous studies (Schaltegger, Hansen and Lüdeke-Freund, 2016; Yang *et al.*, 2017) point out that sustainable and novel business models are achieved through smart technologies, whose models and technologies should be embedded in the organisation strategy. Smart technologies provide new impetus to digital transformation in organisations (Schuelke-Leech, 2018); however, the former, to make successful transformations, needs to be imbued in the organisational culture (Guy, 2019). This is echoed by Lanzolla and Giudici (2017) who argue that smart technologies can drive radical organisational transformation; however, organisations need to develop a set of core capabilities for directors to maximise the effects of smart technologies. Digital transformation as a consequence of the adoption of smart technologies is more likely to occur in mature digital organisations (Kane, Palmer, Phillips, Kiron, and Buckley, 2015) because these companies offer those skills to realise digital transformation (Lanzolla and Giudici, 2017).

However, Merendino *et al.* (2018) find that although smart technologies, e.g., big data analytics, are essential within organisations, they are not always adopted in the strategic decision making by directors because of a lack of capabilities or awareness of their benefits. In the same vein, previous studies (Mikalef *et al.*, 2019; Saunila *et al.*, 2019) point out that smart technologies are not widely adopted and present serious challenges in the implementation of sustainable business models. Professional bodies highlight that, although smart technologies are pivotal for the success of sectors such as aviation, they are not necessarily embedded in their organisational architecture (Mariani *et al.*, 2019). As a

consequence, the imperative of smart technologies is to support the process of creation and implementation of a sustainable business model within organisations (Yoo *et al.*, 2012).

The role of smart technologies in the adoption process of SBMs

Although integrating smart technologies in SBMs can be complex (Hart *et al*., 2003; Zott *et al*., 2011), smart technologies should also favour the design-implementation process of SBMs. The adoption process of SBMs has been analysed from several scholars through several theoretical approaches, such as agency theory, the theory of legitimacy, the theory of the stakeholders and the resource-based view (e.g., Bowen, 2007; Porter and Kramer, 2006; Russo and Fouts, 1997). Prior studies lead to some relevant characterisations: An SBM is a complex phenomenon implying the necessity of a multi-criteria approach, and the adoption of sustainability strategies does not automatically provide positive results.

By integrating the contribution of the previous literature review and the most diffused models on SBMs, a framework coherent with Garzella and Fiorentino's (2014) should be used for analysing the SBM adoption process. The main dimensions of this framework highlight the "what", "why", "when" and "how" of the SBM adoption process. The "what" dimension refers to the typology of SBMs developed by firms. The literature describes different categories of SBMs, each one with its features (Geissdoerfer *et al*., 2018). Bocken *et al*., (2014), in line with Boons and Lüdeke-Freund (2013), systemise the several archetypes of SBMs with reference to three main orientations: technological, showing a dominant technical innovation component (e.g., manufacturing process and product redesign); social, including a dominant social innovation component (e.g., innovations in consumer offerings, changing consumer behaviour); and organisational, characterised by a dominant organisational innovation change component (e.g., changing the fiduciary responsibility of the firm). The "why" dimension focuses on the drivers of the SBM adoption. Firms should engage in SBMs for different reasons. The many reasons can be related to the utility maximisation or the legitimacy theories (Bowen, 2007; Li *et al*., 2017; Porter and Kramer, 2006; Russo and Fouts, 1997; Tan *et al*., 2017). Based on utility maximisation, firms move to SBM adoption for internal motivations to improve their value and performance (Baron, 2001, 2009; Nakamura *et al*., 2001; Servaes and Tamayo, 2013). This literature stream suggests that the main benefits of moving to SBM adoption should be related to the influence on purchase and investment decisions of customers and investors (Miles and Covin, 2002), the optimisation of processes and reduction of costs (Shrivastava, 1995), and the development of organisational competences for competitive advantages (Russo and Fouts, 1997). However, the legitimacy viewpoint emphasises the role of external pressures in SBM adoption (Bowen, 2007; Suchman, 1995). As a result, contextual factors and normative management play key roles in pushing firms toward the integration of sustainability in business models (Freedman and Jaggi, 2017). The "when" dimension embraces the time frame that is required to achieve results. Hart (2005) distinguishes activities - based on the time frame - that are necessary to make business models sustainable. Some firms rely on short-term options to realise short-term performance. The development of sustainable competencies and disruptive innovations may require an excessive period of time compared to firm goals (Lee, 2009), whilst other firms aim at generating the potential for future growth by SBMs (Abell, 1993; Tushman and O'Reilly, 1996). Comprehensive SBMs can be categorised as short-term or long-term options. The "how" dimension regards the way organisations build and develop new SBMs. Previous studies highlight three main ways: (1) a start-up creates an SBM; (2) a transformation of an existing business model can lead to a new SBM; and (3) the sustainable business model is added to the existing business model of the firm by acquisition or internal development (Geissdoerfer *et al.*, 2018).

Regardless of the method for developing and realising an SBM, firms should face relevant organisational changes. The SBM adoption process may take into consideration the set of challenges that prevent organisations from successfully developing their SBMs.

Even though research on business models has evolved in the last decade (Baden-Fuller and Morgan, 2010; Zott *et al*., 2011), the management of a new business model's implementation stage, and even more new SBMs, is still unexplored (Chesbrough, 2007; Foss and Saebi, 2017; Teece, 2006). However, smart technologies should play a key role in supporting the SBM adoption. To understand how smart technologies can support SBMs, the three dimensions of implementation stages, actions needed and challenges should be analysed (Geiessdoerfer *et al*., 2018; Kotter, 2006). Therefore, we contribute to overcome current research gaps by exploring what firms should do to change their business models into SBMs and the main implications of smart technologies for SBM development.

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[1]Different terminology is used in the literature to refer to smart technologies. For instance, Yoo *et al*. (2012) employ the term 'digitalised artefacts', and Guy (2019) uses the term 'digital technology', whereas Schuelke-Leech (2018), 'disruptive technology'. All of these terms refer to the bundles of technologies that enable digital, smart, and disruptive innovation within an organisation.

3. Methodology

3.1. Case study selection

ENAV is an Italian air navigation service provider, owned by the Ministry of Economy and Finances and managed by the Ministry of Infrastructure and Transport, through ENAC, the Italian Civil Aviation Authority. With a workforce of 4,200, it ensures safety and reliability for the 1.8 million flights it handles yearly from the control towers of 45 airports and 4 area control centres. As an air navigation service provider (ANSP), ENAV is responsible for the provisions of the air traffic control service (ATCS), the flight information service (FIS), the aeronautical information service (AIS), and the issuing of weather forecasts for the airports and the airspace under its responsibility. ENAV is a key part of the international air traffic management system, which is why it works with national and international control bodies in the sector. It is a major player in the development of the Single European Sky, which is a programme that aims to harmonise air traffic management throughout the European Union to strengthen continental air transportation safety and efficiency (https://www.borsaitaliana.it/borsa/azioni/profilo-societa-dettaglio.html?isin=IT0005176406andlang=en).

The ENAV Group also includes the subsidiaries Techno Sky SRL, ENAV Asia Pacific Sdn. Bhd. and ENAV North Atlantic LLC. In addition to providing air navigation services pursuant to the law and corporate bylaws, the company is able to guarantee the installation, maintenance and constant monitoring of the flight assistance systems and related hardware and software, to develop and test new technologies and to be present abroad with business consultancy activities and the provision of services in international markets. Specifically, Techno Sky, the logistics and maintenance company of the ENAV Group, ensures full, seamless operating efficiency and availability of Italy's ATC (air traffic control) installations, systems and software products.

In summary, ENAV operates constantly with the following numbers: 117 communications centres; 84 weather systems; 45 airports; 45 radar systems; 4 control centres; 50 control software systems; 4,181 employees; 1.86 million of flights controlled in 2017; 24,699 academy training hours; 115.4 million euros invested in technology (2017); 95 million kg CO_2 emissions in 2017; and 30 million Kg of fuel saved in 2017 (Source: Consolidated disclosure of non-financial information 2017 pursuant to Legislative Decree 254/2016).

Two important elements, connected to each other, characterise the activities carried out by ENAV: safety and technologies. ENAV fosters the development of a safety culture so that the precedence and commitment given to safety are values reflected in the attitudes at all levels: individuals, groups and the organisation. Safety is the result of the ongoing commitment of professional staff in maintaining high levels of safety in all operations.

"Safety and quality of service are the hinges of our business culture and our daily commitment".

The safety at ENAV characterises its mission and vision.

The mission is to guarantee the safety of the millions of passengers flying in the Italian skies, committing themselves every day both as individuals and as a community. The mission of ENAV is: to ensure the safety and punctuality of the millions of passengers who fly in the Italian airspace while contributing to the growth of national and European air transport through ongoing efficiency and innovation.

ENAV has also developed safety indicators to maintain and improve safety performance and to understand and measure the level of effectiveness of the safety management system. For this reason, it is fundamental to have information that can guide ongoing improvement (leading indicators) and data that represent the effectiveness of the system (lagging indicators). However, data alone are not enough: it is essential to understand data and to represent its significant information to improve the levels of safety in our operations (safety intelligence).

The vision of ENAV is "*to create - based on safety - a strategy that is increasingly customer oriented, that modernizes systems and creates value, further strengthening ENAV's presence internationally*". (https://enav.it/sites/public/en/ChiSiamo/mission-vision.html).

The security objective is also linked to the numerous investments that are constantly made in technologies.

"We take care of the sky, guaranteeing the safety, efficiency and regularity for each flight. The guarantee of excellence is also hinged on our three-year investments plans - reviewed annually - of which interventions involving the modernisation of operative technological infrastructures are the main part".

(https://sostenibilita.enav.it/en/safety-continuous-commitment)

3.2. Data collection

To study the case, a specific protocol of analysis was followed (Yin, 2018). After constructing a basic theory, the authors moved to evidence collection. Data collection was conducted combining primary and secondary sources of data (see Table 1), which allowed us to triangulate different sources effectively, e.g., Giudici *et al*., (2018).

[INSERT TABLE 1 ABOUT HERE]

1. Head of corporate social responsibility

All of these sources of evidence were selected and used like a chain (Yin, 2018) through an explicit link between the documents examined, the choices of the subjects to be interviewed and the questions asked. The analysis of the documents and archives was instrumental in the choice of subjects to be interviewed and to formulate the survey questions. We interviewed the following people:

2. Head of communication
3. Head of digital and innovation
4. Chairman of sustainability committee.

The interview with the controller and chief of the CSR process was the starting point for further investigations because it allowed us to identify who else needed to be interviewed. In the first part of the interviews, we encourage interviewees to provide us with a broad account of their experience with the development of the social responsibility project. In the second part of the interviews, we asked more specific questions, informed by our prior analysis, to refine our emerging empirical knowledge on the use of smart technologies during the social responsibility project and examine insights more in depth. Interviews lasted on average one hour. All of them were tape-recorded.

3.3. Data analysis

To study the role of smart technologies in SBMs, we adopted a qualitative approach based on a thematic analysis of the transcripts and documents related to our case study, ENAV. This study applies a blend of inductive and deductive processes (Graebner, Martin, and Roundy, 2012) to critically analyse the wide range of data. Data were analysed using thematic qualitative coding techniques, and during the data analysis, definitions and themes were drawn from the existing literature (Eisenhardt *et al*., 2016). The core categories from the data analysis were initially generated using an open-coding approach (Strauss and Corbin, 1998). Drawing on the principles of triangulation (Jonsen and Jehn, 2009), four researchers were involved in the data analysis to minimise bias and increase confidence in the plausibility of the results. Using a preliminary set of openly coded data as a basis for subsequent coding, two researchers re-analysed the data, assigning a subset of interrelated axial codes to the core category of open codes in a process that 'broke the data apart and delineated concepts to stand for the blocks of raw data' (Corbin and Strauss, 2008, p. 198). The transcriptions, documents and videos were systematically analysed to identify categories and relationships of meanings (Guest *et al*., 2012). During the final stages, the open and emerging axial codes were independently reviewed by other researchers (Eisenhardt *et al*., 2016). The researchers collaboratively reviewed the results to isolate any

discrepancies in our core categories and sub-themes until an acceptable level of reliability was achieved (Bryman, 2012). Throughout the data analysis, we referred to previous research to continuously improve the inductive theoretical insights (Eisenhardt, 1989). Through this rigorous data analysis process, the research team maximised intercoder reliability and intercoder agreement (Graebner *et al*., 2012).
From our data analysis, we have identified two core categories "the process of SBM development" and "the role of smart technologies in SBM development" and, respectively, four sub-themes (why, when, how, and what) for the first core category and three sub-themes (unfreeze, change and refreeze) for the second, as shown by Table 2.

[INSERT TABLE 2 ABOUT HERE]

4. Findings

Our explorative research aimed to provide an understanding of the role that the smart technologies covered for the development of a sustainable business model at ENAV S.p.A. We analysed the results with reference to two main aspects:

- the analysis of the sustainable business model developed by ENAV. We analysed this according to four questions: why, where, how and what;
- the role of smart technologies for the development of the sustainable business model at ENAV. To analyse this aspect, we considered the 8 steps in the model by Kotter (2006).

4.1. The SBM adoption

"Why and when"

In 2017, ENAV starts to develop a social responsibility project. The need to develop this process is linked to the new legislation (Legislative Decree 254/2016), which provides for the obligation for large companies or groups and public-interest entities [2] to draw up a social responsibility project, together with the traditional financial reporting and the disclosure of non-financial and diversity information, such as environmental, social aspects, those relating to personnel, respect for human rights, and the fight against active and passive corruption.

To adhere to the legislation, ENAV therefore, had the need to design a system of key performance indicators of a non-financial nature adopting specific principles and methodologies provided by the most recent standards published in 2016 by the Global Reporting Initiatives ("GRI Standards - GRI-referenced option") and to develop a three-year sustainability plan.

"How"

First, a special structure on sustainability is created within the communication function to develop the SBM project. Previously, the communication functional area was responsible for internal and external communication, and the press office. ENAV's directors have recently established a new team within this functional area accountable to SBM communication.

For ENAV, sustainability is a business project to launch.

"We discussed sustainability as if it were a start-up within the company, with aspects treated as business projects to launch, working on three variables: commitment, engagement and governance"

(Head of corporate social responsibility)

ENAV's SBM was based on three main pillars:

- Commitment: ENAV has created the sustainability ambassador, a group of approximately 30 business professionals who are not only the "megaphone" to the rest of the company but also an element of constant exchange to create new projects and develop new projects within the sustainability.

- Engagement: ENAV has developed the "stakeholder engagement" strategy by the materiality matrix. With a careful analysis of the context in which we operate, we have identified the aspects of our activity that may generate significant social, economic and environmental impacts, influencing expectations, decisions and actions by our stakeholders. Having assessed the various directions of the group and established a priority ranking defined according to the significance of the impact for the company and stakeholders, the relevant subjects have been set out in the materiality matrix, which identifies the main areas in which we are committed to developing concrete actions and consistent initiatives (https://sostenibilita.enav.it/en/).

- Governance: On 27th June 2018, the board of directors institutes the sustainability committee to promote and supervise sustainability policies in connection with the performance of ENAV's activities and its interactions with stakeholders. The composition, duties and operation of the sustainability committee are set out in the committee rules approved with a resolution of the board of directors on 2nd August 2018. The aspects related to the governance also include the mapping of non-financial risks.

To generate real environmental benefits, ENAV offers increasingly efficient routes that reduce both travel time and fuel consumption leading to a reduction in CO2 emissions. In this respect, ENAV has launched two main projects:

- Flight efficiency plan. For the last ten years now, ENAV has been preparing a flight efficiency plan (FEP). Free Route Italy is a revolutionary project that made it possible for all flying aircraft at an altitude of over 9,000 metres to cross the Italian skies with a direct path without reference to a precise network of routes. Thanks to Free Route Italy, in 2017, it was possible to generate annual savings of approximately 30 million kg of fuel, equal to approximately 95 million kg of CO2 that have not been dispersed into the environment. The data obtained for 2018 show even higher efficiencies: thanks to the possibility for companies to choose more efficient routes, it appears that the distances travelled by aircraft in the last year have decreased by 12 million km with a consequent reduction of 43 million kg of fuel and approximately 135 million kg fewer CO2 emissions, "*more*

than 100 million euros saved in fuel in the last five years for our customers" (Source: Consolidated disclosure non-financial information 2018).

- Free Route Italy. In December 2016, six years ahead of the deadline set by the Single European Sky regulation, ENAV implemented Free Route Italy (FRAIT). This project has made it possible for all aircraft flying above 11,000 metres to cross Italian skies directly, no longer needing to refer to the route network. Starting in May 2018, this height was lowered to 9000 feet. This is a revolutionary project for national and European air transport. It allows airlines to plan the shortest possible trajectories, flying directly from an entry point to an exit point of the Italian airspace and thereby saving on fuel, harmful emissions and, consequently, costs whilst maintaining safety levels.

"What"

The current literature does not offer a general conceptual definition of the sustainable business model (Boons *et al*., 2013; Bocken *et al*., 2014). Therefore, we use the following three different streams of analysis, which appear to be the most important, to examine what the sustainable business model developed at ENAV S.p.A. is: technological, organisational and social innovation (Boons *et al*., 2013).

Regarding technological innovation, ENAV has developed a new business model employing their existing technologies. The development of the new business model is not triggered by new technologies and vice versa. Existing products have been offered in new ways based on new applications.

"It would have been impossible to create a sustainable business model without the technologies already present at ENAV. All the work that ENAV carries out is based on the use of technologies."

(Head of digital and innovation)

The organisational innovation is another pivotal aspect of ENAV's sustainable development. The development of a new sustainable business model is related to a more general interpretation of "doing business". ENAV implements significant organisational adaptations to secure legitimacy and legality, and not least, business success. A unique team on sustainability is created within the communication functional area to develop the SBM project. ENAV has implemented alternative paradigms that have shaped its culture, structure and routines, and thus changed the way of doing business towards sustainable development. At ENAV, the sustainable business model is the aggregate of these diverse organisational aspects.

The third stream of analysis is related to social innovation. At ENAV, this approach is the key to creating and transforming markets toward sustainable development and to increase passenger security. Social innovation is primarily oriented towards social purposes and missions as it provides solutions to the problems of stakeholders. The sustainable business model allows ENAV to create social value and maximise social profit as it helps to create and develop markets for innovations with a social purpose.

"It is important for ENAV to make a tangible contribution to society; it is part of our sustainability initiatives"

(Head of communication and investor relations)

"ENAV has begun to develop a series of initiatives that have obviously started with regulatory compliance and then proceeded through a challenging and fascinating process of creating value through sustainability. We had a clear goal: to create value through sustainability for both the company and, of course, for the society around us"

(Head of corporate social responsibility)

4.2. The role of smart technologies for the development of the sustainability business model at ENAV

Our data show that the use of smart technologies represents an indispensable need within ENAV's business activities.

"Hence, if by sustainability we mean business survival, then to us, technology is the very existence of business"

(Head of communication)

Smart technologies play a leading role at ENAV, especially in the framework of a sustainability-oriented business model.

"CSR does not originate a process from zero. It is technology that helps CSR, not CSR that helps technology"

(Chairman of sustainability committee)

The eight-stage Kotter (2006) framework, revisited by Geissdoerfer *et al*. (2018), helps to understand the role of smart technologies in the implementation process of ENAV's sustainability-oriented business model.
With regards to the first "*establish a sense of urgency*" stage, the contribution of smart technologies is fundamental while drawing the non-financial statement in compliance with Law Decree 254/2016. ENAV implemented an integrated ERP in Oracle mode to comply with the new regulation.

"The passage is that there was no ERP system. Up until the development of this ERP system, we used to manage financial reporting with the classic Excel worksheet. So, let's say, you understand, that going to work in a company of this size was at a level of high complexity even on our part; you get dozens and dozens of Excel sheets that you have to process and send back if, let's data have not been completed correctly. Having an ERP system allows you to rely on a system, a unique and constant place of exchange, between us and the various executives and then also towards the legal auditor, who carries on that kind of work downstream from what we do"

(Head of corporate social responsibility)

The centrality of smart technologies, in particular of the Internet of Things, is relevant concerning the actions needed to create a team with shared commitment and the power to lead the change and encourage the group to work as a team outside the typical hierarchy. Therefore, smart technologies contribute "to form a powerful guiding coalition" (2nd stage). Throughout 2018, the group has placed increasing emphasis on change management. It has implemented a significant reorganisation process of human capital management, leading to the creation of an *ad hoc* human capital and change management

unit (Source: Sustainability Report 2018 - Consolidated disclosure of non-financial information according to Legislative Decree 254/2016).

The centrality of smart technologies is also evident regarding the third stage, “create a vision”.

The vision of ENAV is “to create - based on safety - a strategy that is increasingly customer oriented that modernizes systems and creates value, further strengthening ENAV's presence internationally”.

(https://enav.it/sites/public/en/ChiSiamo/mission-vision.html)

The achievement of such a strategy depends on the level of investments in operational technological infrastructures. Such investments have a direct impact on the core business activities in terms of the safety, efficiency and cost-effectiveness of air traffic management services (Source: Sustainability Report 2018).

In line with technological changes occurring internationally in the aviation sector, ENAV has crafted a technical operation development plan. The latter aims to maintain ENAV’s competitiveness on an international stage, consolidate its leadership in technological innovation and comply with the Single European Sky requirements (Source: Sustainability Report 2018).

“The guarantee of excellence is also hinged on our three-year investments plans - reviewed annually - of which interventions involving the modernization of operative technological infrastructures are the main part”.

(https://sostenibilita.enav.it/en/safety-continuous-commitment)

The business plan forecasts investments in innovative technological platforms and systems for air traffic control for the 2018-2022 period to maintain high levels of performance and to ensure maximum safety. Considering ENAV’s primary objective to support air traffic management services in the national territory, in 2018, the ENAV Group invested €113 million in a number of infrastructures (out of a total investment of €116.9 million). It implemented and maintained projects for operational technological infrastructures, an improved ATM technology platform with new operational concepts, and revised equipment and management information systems (Source: Sustainability Report 2018).

With reference to the fourth step, “communicate the vision”, an important contribution comes from the Internet of Things, both externally – through social media, ENAV’s web platform and YouTube – and internally – through the FollowMe portal.

Regarding the external communication, the press office communicates ENAV’s vision through different channels. It employs the traditional media relations, targets specific audiences (e.g., businesses) depending on the messages ENAV wants to deliver, and directly manages and monitors social platforms such as Twitter, Instagram and LinkedIn. Such social platforms result to be particularly strategic to communicate ENAV’s vision as confirmed by the growing number of followers, approximately 12,000 followers in 2018 (Source: Sustainability Report 2018).

ENAV creates a new platform dedicated entirely to sustainability (https://sostenibilità.enav.it/en). This new website seeks to improve the communication of ENAV's vision together with its traditional company website.

"Then, we have developed a web platform that practically serves to spread detailed information on sustainability, which is clearly connected to the corporate site, which we are now further implementing with other initiatives".

(Head of corporate social responsibility)

ENAV has launched its own YouTube channel. We found that it was particularly useful to communicate its vision and engage with stakeholders considering the high number of videos (over 300), subscribers (over 1,800) and views (over 211,000) in 2018.

Regarding internal communication, the FollowMe portal plays a pivotal role. It is an integral part of ENAV's Digital Workplace; it is the main internal communication tool for the employees of the ENAV Group, through which it is possible to share corporate news, events and press reviews, while ensuring full compliance with the needs of the company in terms of organisation, content and usability (Source: Sustainability Report 2018).

In the last few years, ENAV has developed several projects and actions that were aimed to involve people in the organisational and strategic dynamics and, above all, to empower them to act on the vision (5th step - "empowering others to act on the vision"). The most relevant project is ENAV's Digital Workplace. It is a "cloud location" where it is possible to operate in a "smart-working" mode.

In the last few years, together with our colleagues from Communication, but also from Human Resources, we have implemented the innovative digital workplace model. This is due to the fact that our core business, as you know, occurs through our air traffic controllers, our maintainers, and all the staff that operate directly on the field and have no easy access to, or normally do not work at, an IT post. Hence, the need to bring the company's message close to the company's core business is something that has matured over the time. (Head of digital and innovation)

Digital IT represents an important contribution to the digital workplace and communication, as well as the digitalisation and e-procurement topics. When referring to the digital technologies utilised, the very same head of digital and innovation remarks:

"From the point of view of communication and employee endorsement, we refer to digital activities related to the utilization of cloud hybrid platforms, which therefore favour this model of collaboration and productivity of the digital workplace, and consequently, the capability to get in contact with all the members of the company's population through telematics platforms, and to work remotely in a highly efficient model, also promoting mechanisms of smart working.

From under the point of view of new paradigms, like for instance the Internet of things, machine learning or blockchain, we have specific digital projects which we face directly with our product owner and which range from the informatized, efficient management of work-shifts to the mechanisms related to the utilization of blockchain for information considered as particularly important or sensitive."

ENAV employs the IoT to maximise the benefits of the usage of drones for recreational and professional purposes. In 2018, ENAV set up a new company, D-Flight, specialised in the use of drones and IoT to increase the level of safety in the skies (UTM, 2019). This ST allows ENAV to monitor whether it is possible to fly in the Italian territory and the flight conditions. An informant, however, points out that more research and experimentations are needed to improve the IoT in relation to drones (Sergio Barlocchetti). In this respect, ENAV launched a tender process aimed at identifying potential partners with whom to create new technologies to improve their IoT and drones technology (ENAV, Financial Report 2017 and 2018).

On the other hand, ENAV uses blockchain technology for tracking and flight registration and collision avoidance. ENAV became the world's first air navigation space provider to provide a large-scale plan to adopt IoT and Blockchain technologies to guarantee safety in the skies and improve aircraft traffic management (Canso, 2018).

The centrality of smart technologies can also be traced in the 6th step of Kotter's (2006) framework "planning for and creating short-term wins". Despite the inevitable multi-year perspective of programming tools such as technical operations development and business plans for 2018-2022, it is also possible to define and engineer visible performance improvements in the short term. For example, airlines crossing Italian skies in 2018 saved a total of 43 million kg of fuel, with a reduction in CO2 emissions amounting to approximately 135 million kg (Source: Sustainability Report, 2018). This is possible through the project 'Free Route Procedure' introduced by ENAV as a clear example of technology-derived environmental and economic performance.

Smart technologies represent for ENAV one of the drivers of its core business. The sustainable results achieved through smart technologies allow ENAV to consolidate improvements and produce more change (7th step). Such consolidation is mainly supported by two actions. First, ENAV reinvigorates the change process with its participation in new projects, such as Data Link, the Medium-Term Conflict, Detection (MTCD), the new 4-Flight system and the new E-NET 2 network with multiprotocol label switching technology (Source: Sustainability Report 2018). ENAV participates in the most important global research programmes, e.g., the European Commission's SESAR programme is one of the most significant (https://www.enav.it/sites/public/en/Servizi/RESEARCH--DEVELOPMENT.html).

As a result, ENAV can drive change at the international level and orient its strategic objectives with the development of smart technologies according the future European ATM system.

It was fundamental for ENAV to anchor smart technologies to its corporate culture and sustainability-oriented business model considering the stringent regulatory context and organisational objectives. We find that two factors are paramount in institutionalising change in the corporate culture (8th stage): first, the conscious attempt to show people how the new approaches, behaviours, and attitudes improve performance through the internal communication (see 4th stage); and second, the creation of leadership development by promoting people into leadership positions who personify the corporate approach through the creation of a dedicated human capital and change management unit (see 2nd stage).

All in all, the eight stages entailed by the Kotter model (2006) and found in the case under analysis can be traced back to the three steps of Schein's 'Lewinian' Model of Change/Learning (2010), which follow the 'unfreeze–change–refreeze' or 'changing as three steps' Lewin model (CATS) (1947). The first three stages of the Kotter model (2006) can be traced back to the first step of Schein's 'Lewinian' Model (2010) "Unfreezing: creating the motivation to change"; stages 4, 5 and 6 can be found in the

second step, “Learning new concepts”, whereas stages 7 and 8 can be found in the third step, “Institutionalising new concepts”.

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[2] These entities are required to prepare a non-financial statement if they had more than 500 employees on average during the financial year and, at the reporting date, exceeded at least one of the following limits: total balance sheet exceeding 20 million euros and/or total net revenue from sales and services exceeding 40 million euros.

5. Conclusions limitations and future research

This paper analyses the role of smart technologies in the SBM adoption process of an illustrative case study. To achieve sustainable business models, companies should incorporate sustainability into their strategic management practices (Engert and Baumgartner, 2016; Epstein and Roy, 2001). Despite their potential, until today, smart technologies have played a minimal role in ENAV’s SBM adoption. However, the smart technologies show the potential to inform the SBM adoption process. The paper analyses the topic of sustainability in the air navigation service sector, which is not well explored yet.

ENAV, based on industry-specific reasons, has complex ICT systems. In these systems, the firm has developed smart technologies, mainly big data analytics tools. However, despite of the relevance of these technologies, the possible implications have been long overlooked until the firm was pushed to SBM development for compliance reasons. The findings from the case study support the idea that the business value and the strategic relevance of smart technologies still remain largely underestimated in SBM adoption (Mikalef *et al*., 2017). However, the case study also highlights new insights on the prospective implications of smart technologies for SBM development. Specifically, our findings suggest that firms should fathom the potential of smart technologies for SBM adoption. On the one hand, smart technologies show an explicit capability to contribute to corporate communication for external stakeholders by providing useful data for disclosure. These data favour relations with organisations and customers, and with institutions facilitating regulatory compliance (e.g., new ICT systems favour the measurement of relevant sustainability performance indicators). On the other hand, smart technologies reveal an implicit capability to contribute to the main dimensions of SBMs such as safety and security (e.g., big data analytics support the safety of air navigation by providing a vast amount of data on airplane routes) or the respect for social and environmental criteria in the supply chain (e.g., the “free routes” project allows for the reduction of CO2 emissions).

With reference to the SBM adoption process, according to legitimacy theory, contextual factors and normative management have emerged as key factors (Bowen, 2007; Freedman and Jaggi, 2017; Suchman, 1995). Case study findings confirm that when legitimacy is the driver, SBMs are mainly based on a reactive approach and on short-term goals (Garzella and Fiorentino, 2014; Hart, 2005). The “why” and “when” affect also the “what” of SBM adoption. The findings show that the SBM of ENAV has given precedence to actions observable to external stakeholders (Engert and Baumgartner, 2016; Epstein and Buhovc, 2008). In this sense, the focus on disclosure activities has pushed towards a dominant organisational change component (Boons and Lüdeke-Freund, 2013) and the SBM adoption has highlighted the need for cross-functional teams and activities (Baumgartner, 2014). Finally,

regarding how the firm develops and realises a new SBM, ENAV has internally developed the SBM (Geissdoerfer *et al*., 2018).

With regard to the role of smart technologies in the SBM adoption process, the case study is characterised for the use of smart technologies representing an indispensable need within ENAV's business activities. Our findings support the idea that smart technologies can play a key role in several stages of the change management process related to SBM adoption (Kotter, 2006; Geissdoerfer *et al*., 2018). These technologies, e.g., the "free route project", have helped, sometimes also in an unconscious way, the adoption of the SBM. Overall, smart technologies have supported the development of corporate cultures and sustainability-oriented business models considering the stringent regulatory context and organisational objectives.

Our study makes significant contributions to theory and practice. First, this research advances our understanding of the role of smart technologies in the Kotter (2006) and Schein (2010) model. Second, our study enriches Garzella and Fiorentino's (2014) framework of SBMs. Third, we contribute to the growing yet inchoate studies on smart technologies by clarifying what their roles are in the creation of sustainable models.

Specifically, we provide empirical evidence to academic research investigating tools and processes supporting organisations in the design of business models. In line with *Evans et al*. (2014) and different from prior studies, we have analysed the overall SBM adoption process to embrace all the phases in a comprehensive process. We, therefore, contribute to the underdeveloped research on the challenges that SBMs face and on the reasons for low success rates in implementation (Hughes, 2011).

Regarding the contribution to practice, this study seeks to support organisations and their directors to build and improve sustainable business models through smart technologies to maintain their competitive advantages. Our findings have relevant implications for firms adopting SBMs. We offer guidance along the challenges of the SBM adoption process and we unravel the overlooked role of smart technologies in this process. Our findings suggest that smart technologies can help organisations bridge the design-implementation gap of sustainable business models. Indeed, shedding light on challenges related to SBM adoption and improving the success rate of these processes should have societal implications. With specific regard to the sector analysed, by this study emerges how the use of smart technologies is relevant and indispensable for the implementation and the development of an SBM. Therefore, in companies of this type, it is necessary to develop a collaboration among all the actors responsible for the CSR project and those involved in the implementation and development of new technologies, so that an effective SBM can be obtained.

The insights on the role of smart technologies, as considered in this study, suggest that future research should expand our findings by the investigation of large samples. Indeed, future research should analyse how different national and cultural contexts affect the role of smart technologies in SBM adoption. Moreover, the impact of sustainable business models on smart technology development should be studied.

This paper is subject to certain limitations. First, this study considers a single case company in the air navigation services industry. Thus, our research suffers the generalisability issues commonly encountered by single case studies with its focus on a national context, Italy, and its culture and law (Yin, 2013). However, although there are limitations of the qualitative analysis methodologies (Unerman, 2000), the use of triangulation principles might provide the rigorous processing of the issues.

Second, this study focuses on smart technologies, in general, without delving into specific technologies given the exploratory nature of this research. Therefore, future research can expand our analysis by taking into account how a specific smart technology, such as the Internet of Things or blockchain, impacts the SBM.

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Table 1
Main data sources and uses

Data sources	Type of data	Use in the analysis (e.g., gathering, gaining, triangulating)
Semi-structured interviews (68 pages)	**Semi-structured interview with the head of corporate social responsibility**	Gathering data regarding the reasons underlying the adoption and implementation of a sustainable business model (SBM) at ENAV. Gaining an initial understanding of the role that smart technologies (ST) covered for the development of an SBM at ENAV.
	Semi-structured interview with the head of communication	Gathering further investigation on the steps/variables on which the implementation of an SBM is based. Gaining a better understanding of the degree of the use of ST before implementing the SBM. Gaining a better understanding of the role of communication in the adoption of the SBM.
	Semi-structured interview with the chairman of the sustainability committee	Gathering further investigation on the steps/variables on which the implementation of the SBM is based. Gaining a better understanding of the role of the sustainability committee in the adoption of the SBM. Triangulating facts and observation provided by other interviewees regarding organisational and governance aspects in the adoption of the SBM.
	Semi-structured interview with the head of digital & innovation	Gaining a better understanding the role of ST in the adoption of the SBM. Triangulating facts and observations provided by other interviewees with regard to the technological innovation aspects in the adoption of the SBM.

Archival data	**Internal ENAV documentation** *Printed*: Press releases for 2017 (35 pages); for 2018 (47 pages); for 2019 (35 pages)	Triangulating facts and observations to overcome the limitations of the interviewees' rhetoric.
	Public ENAV documentation *Printed:* ENAV's monthly magazine for 2017 (180 pages), 2018 (200 pages), and 2019 (200 pages), until July (580 pages overall); Consolidated disclosure of non-financial information 2017 pursuant to Legislative Decree 254/2016 (172 pages); Sustainability report 2018 (94 pages); ENAV's website (regular monitoring); Sustainability on ENAV's website (regular monitoring); ENAV's LinkedIn page dedicated to sustainability (regular monitoring).	Supporting, integrating and crosschecking interview-based accounts. Triangulating facts and observations to improve the validity of the insights emerging from the interviews. Triangulating facts and observations to improve the understanding of the timing of SBM adoption. Defining the boundaries of interviewees' rhetoric. Gaining further facts and observations to improve the validity of the insights emerging from the interviews.
	Press coverage (mainly through Dow Jones' Factiva) 50 articles each for 2017 (107 pages); 84 articles each for 2018 (139 pages); 89 articles each for 2019 (135 pages). Total 223 articles (381 pages)	Enriching the database of evidence with third-party data. Triangulating facts and observations to overcome the limitation of interviewees' rhetoric.

	Videos, downloaded from the Internet 5 videos from national and regional media each for 2017 (22 min and 20 seconds, un-transcribed); 19 videos from international, national and regional media each for 2018 (1 hour, 49 minutes and 17 seconds, un-transcribed); 21 videos from international, national and regional media each for 2019 (1 hour, 41 minutes and 19 seconds, un-transcribed) youtube.com/user/ENAVchannel (regular monitoring) one institutional video on Sustainability ENAV (2 min and 56 seconds, un-transcribed)	Triangulating facts and observations to overcome the limitation of ENAV's corporate rhetoric. Enriching the database of evidence with third-party data.

Table 2
Final Data Structure

1st-order concepts	*Sub-themes*	*Core categories*
To comply with Legislative Decree 254/2016	Why	SBM adoption
In 2017	When	
Created a special structure on sustainability within the communication function to develop the SBM project *Created the sustainability ambassador* *Developed the stakeholder engagement* *Instituted the sustainability committee* *Launched two main projects leading to a reduction in CO2 emissions*	How	
Technological innovation *Organisational innovation* *Social innovation*	What	
Establishing a sense of urgency *Forming a powerful guiding coalition* *Creating a vision*	Unfreezing: creating the motivation to change	
Communicating the vision *Empowering others to act on the vision* *Planning for and creating short-term wins*	Learning new concepts	

Consolidating improvements and producing still more change *Institutionalising new approaches*	Institutionalising new concepts	Role of ST in SBM development