Data-driven business model development – insights from the facility management industry

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Abstract

Purpose – One of the leading factors that shape product and service delivery are data collected in databases and other repositories maintained by companies. The transformation of such data into knowledge and wisdom may constitute a new source of income. This paper aims to explore how small/medium-sized enterprises (SMEs) advance their business models (BMs) around data to handle data-driven products and how this contributes to their innovativeness and performance.

Design/methodology/approach – To investigate the phenomenon, the as-is BM of a multinational SME was mapped and its limitations were revealed through a qualitative study. The BM canvas was used. Then the data-driven approach was innovated within the facility management (FM) industry, where a high volume of operational and sensor-based data being collected creates added value in terms of new data-based products.

Findings – A data-driven business model (DDBM) blueprint for the FM industry that supports the need to complement service-driven operations with the data-driven approach is delivered. Enhanced BM equips a facility manager with additional managerial tools that enable decreasing property utilization costs and opens up new opportunities for generating revenue. This paper drafts the way to evolve from service to data-driven business and point out the attitudes that managers should adopt to promote and implement DDBM.

Practical implications – The DDBM constitutes a guideline that supports FM organizations in focusing their activities and resources on generating business value from data and monetizing data-driven products.

Originality/value – The research expands knowledge regarding BMs and their evolution. The gap regarding the DDBM innovation within the FM industry is filled.

Keywords Business model innovation, Big data, Facility management, Data-driven business model, Transition economy

Paper type Case study

1. Introduction
Modern companies worldwide introduce technology-based innovations not only to streamline their business operations and increase competitive advantage – but also to carve

out new markets (Wang and Xu, 2018), meet policies put in place by governments and various regulators, as well as make their businesses more sustainable. Companies that obtain higher technological innovation efficiency are reported to be among those that achieve the highest growth rates (Martínez-Alonso *et al.*, 2019). As maintenance of the built environment is concerned, it is bolstering the energy efficiency of buildings, systems and devices through telemetry based on the Internet of Things and data analytics that is one of the leading technology-related trends nowadays (Konanahalli *et al.*, 2018). It not only equips an interested company with instruments necessary to expand further in the era of rising energy carriers' prices through eliminating energy waste; it also exerts a positive impact on the environment that cannot be brought down to positive publicity.

When considering company-wide technological innovation, one must bear in mind that digitalization is not curbed to isolated projects; rather, entire business models (BMs) shift considerably toward digital environments (Kraus *et al.*, 2019). Businesses originating from emerging/transition economies face unique challenges and conditions regarding technological innovation (Bala and Feng, 2019) – in particular when they have global ambitions. The necessity to abandon imitation strategy (that proved effective in earlier stages of multi-nationalization) and radically re-structure their BMs puts such businesses at a double disadvantage. Not only entering rapidly into remote markets using high-commitment strategies such as acquisitions – and therefore breaking significant entry barriers – is often required (Marchand, 2018), but companies from emerging/transition economies tend to lag behind the competition from developed ones with respect to the maturity level of information technology (IT) (Keszey, 2017), as well as capital.

It is Big Data that might be considered one of the leading technologies behind rolling out complimentary services and securing additional revenue streams by a company. It enables organizations to establish data analytics and to integrate data in real-time from a variety of sources (Bange *et al.*, 2015) with supporting information-sharing and decision-making in mind (Mandal, 2019). With the availability of volume, velocity, variety and data veracity (4 V), new business opportunities are presented (Erevelles *et al.*, 2016). Mature companies – such as Apple and Amazon – focus on business model innovation (BMI) around Big Data to approach their customers with new services and products, as well as to secure additional revenue streams (Lokitz, 2018). The concept of a data-driven business model (DDBM) is built around data as a product – it lays out benefits for users of data-based services and introduces methods for managing (i.e. promoting, pricing, sale and delivery) of such products (Bange and Derwisch, 2016). Attention to BMI has been increasing throughout business practice and research (Amit and Zott, 2012) for some time. However, leveraging Big Data and constructing DDBMs invariably remains a challenge for many companies. Facility management (FM) is a service-oriented profession that encompasses multiple disciplines to ensure the functionality of the built environment by integrating people, place, process and technology (IFMA, 2012). Property owners usually outsource the bulk of maintenance activities to external business partners. Related sources describe BMs within this industry in terms of a relationship between a property owner and an FM services provider – and BMI is perceived as improving FM processes, configuring organizational structures, day-to-day management, risk management and cost-effectiveness (Nardelli and Rajala, 2018; Jensen, 2011).

We observed the lack of proficiency within FM regarding BMI focused on Big Data, information, knowledge and wisdom – all of which are being collected in the structures and systems of FM companies during service processes executions. Hence, upon taking advantage of the feedback regarding the initial research design (Gawin and Marcinkowski, 2017a), a couple of research questions have been posed:

RQ1. What is the role of Big Data in BMI within the FM industry?

RQ2. What components of a DDBM might be considered FM-specific?

Our research focuses on how FM companies advance their BMs on account of Big Data collection, processing and analysis. The goal of the study is to develop a reference DDBM in which a considerable share of FM organization's revenues come from knowledge and wisdom captured in a systematic and orderly manner across the company's IT ecosystem.

The subsequent section of the manuscript establishes a research background for our study in Section 2. Then, the research approach, setting and methods used are provided in Section 3. Findings of the study are discussed next: the as-is BM of a multinational FM company is addressed, its deficiencies revealed, ensued by conceptualizing a DDBM framework that has been put in practice as a target model in Section 4. Empirical validation of the DDBM is introduced in Section 5. Subsequently, the theoretical and practical implications are discussed along with the limitations of the study in Section 6, followed by conclusions in Section 7.

2. Literature review
2.1 Data and big data
Data and business intelligence (BI) solutions are recognized as a driving force behind not only contemporary global organizations – but for small/medium-sized enterprises and start-ups as well (Rotella, 2012). Yet, not all data is valuable. To make efficient data-based decisions, data must come in digital form, be arranged, cleared of incorrect records and data gaps, integrated, as well as provided to decision-makers at the right place and time without undue delay – just to name a few preconditions. As data becomes more refined, companies begin to recognize it as an enterprise-wide asset, whereas employees and managers start to work with it more instinctively. Bulks of data in business are constantly increasing. A notion of Big Data refers to data that comes in enormous volumes (Bange and Derwisch, 2016), in many different formats and forms, while being generated (and inevitably also processed) with high intensity – and not without risk of inaccuracies, gaps and other factors that potentially reduce the reliability of data. Nowadays, Big Data became a tremendously vast concept that includes different subcategories and specifics, which are characterized by different technical and regulatory challenges (Favaretto *et al.*, 2020). While Big Data tend to rely heavily on unstructured data sources, companies setting up BI solutions that take advantage of Big Data repositories to lean toward database-related sources – just to mention Enterprise Systems and their sub-classes.

Dissemination of Big Data has the potential to revolutionize the way companies set up their BMs and build their competitive advantages to define their advantages over competitors. According to McAfee and Brynjolfsson (2012), productivity and profitability indicators of companies that inject Big Data and analytics into their operations are reported to be 5% to 6% higher than those of their peers. A study effectuated among 232 medium-sized and large UK manufacturing companies by Cao and Duan (2017) demonstrated that top-performing enterprises are 5.31 to 7.56 times more likely to make data-driven decisions than bottom-performing ones; on top of that, top-performing companies – in contrast to their peers – have a statistically significant correlation between descriptive analytics and organizational strategy.

2.2 Business models

BMs play a fundamental role in attempts to commercialize the technology, and thus achieve its objective economic value (Chesbrough, 2010). As pointed out by Mazzarol *et al.* (2018), a BM might be considered an endlessly evolving conceptual tool that draws together the logic behind a business venture. It depicts how products, services, image, distribution, organization of staff and the operational infrastructure are uniquely put together by a company to generate value for customers (Chesbrough and Rosenbloom, 2002). As classified by Zott *et al.* (2011), research on BMs generally falls into three major categories:

(1) e-business and the use of IT in organizations;
(2) strategic issues – such as value creation, competitive advantage and performance of a company; and
(3) innovation and technology management.

The extant body of knowledge from BM research is focused on more generic BM frameworks (Johnson *et al.*, 2008; Bouwman *et al.*, 2008). According to Chesbrough and Rosenbloom (2002), BMs articulate value propositions, identify market segments and define value chains within companies. For instance, the framework of Johnson *et al.* (2008) delivers a value proposition based on four interlocking components – customer value proposition, profit formula, key resources and key processes. The Service/Technology/Organization and Finance (STOF) model discussed by Bouwman *et al.* (2008) features services, technology platforms/architecture, ecosystems, as well as finance and risk-related uncertainties. On the other hand, the practitioner-oriented BM canvas consists of nine building blocks, namely, value proposition, key processes, key resources, key partners, customer relationships, channels, customer segment, revenue streams and cost structure (Osterwalder and Pigneur, 2010). Hartmann *et al.* (2016) attempt generalizing identified static BM frameworks in a systematic manner, stressing that there is no general agreement on BM dimensions – and leaving some significant Canvas concepts aside.

In the digital age, most contributions refer to BMs that rely on data. Bange and Derwisch (2016) highlight four challenges in implementing data products: a BM in place, marketing and sales, delivery of data-based products, as well as data management. On top of that, Batra (2017) reports that the target group of business users who demand access to superior predictions escalates and analytics becomes more interactive. Three categories of BMs built around Big Data are distinguished by Lokitz (2018) based on their value propositions and customers: data, information and answers as services.

2.3 Business model innovation

Björkdahl and Magnus (2013) consider BMI in terms of a new integrated logic of value creation and value capture, which can comprise a new combination of novel and old products or services, as well as changes in both market position and process management of a company. Amit and Zott (2012) seek BMI in enhancing current BMs with revelatory activities, taking advantage of original linkages within activity structure and changing one or more parties that perform any of the existing activities. As pointed out by Lindgardt *et al.* (2009), BMI may be considered a multidimensional and orchestrated set of activities that lead to the re-invention of at least two BM components to deliver value in new ways. As BMI positively mediates the relationship between integrative capability and company performance, it is up to managers to take advantage of it to improve company performance and understand that BMI's role varies across different business strategies (Pang *et al.*, 2019). Barton and Court (2012) highlight the milestones of putting a data-driven strategy in place:

- choose the right data and sources using IT support; then
- build models that predict and optimize business outcomes; and
- transform the capabilities of the company.

On the other hand, Liu and Bell (2019) strongly stress the importance of the following factors in the BMI process effectuated in emerging/transition economies:

- development of a strong and loyal customer base;
- active customer feedback to ensure the product meets customer needs and to avoid expensive mistakes going forward;
- extension of the value network to ensure finance is available to allow both product development and BM development; and
- development of the network to take advantage of collaborative opportunities.

Making the most of Big Data translates to having a definite BM and placing it right in the center of the business. FM industry, to date, seems to undervalue the necessity of taking advantage of the benefits that data-orientation provide. For instance, Nardelli and Rajala (2018) discuss the evolution of BMs within FM, focusing on BMI – yet their research stresses the aspect of inter-organizational collaboration across different phases of the innovation process, leaving data itself aside. A report for the Royal Institution of Chartered Surveyors clearly indicates the need for gathering, processing and taking advantage of knowledge within the FM industry (Mehdi, 2018). That being said, both monetization of data-based products and fitting such products into FM BMs are neglected by the report. Similarly, a report jointly branded by the International Facility Management Association and the Royal Institution of Chartered Surveyors (Ware et al., 2017) says a lot about adapting BMs to take advantage of new technologies but provides neither real-life examples of such changes nor guidelines for introducing them.

The BMs used to-date in numerous industries including FM (Bouwman et al., 2008; Johnson et al., 2008; Nardelli and Rajala, 2018; Hartmann et al., 2016) feature technological components or abstract constructs that potentially bring together systems and applications of both transactional and analytical nature. However, the fact that in the era of Big Data and BI, data is the fuel supplying organizational knowledge and wisdom necessary for agile business operations seems to be neglected. Then, although reports from international organizations confirm that FM BMs shall evolve toward data management, it is challenging to identify best practices or real-life applications of reference models that may constitute the basis for tailor-fitting. Therefore, we consider the low level of FM industry maturity regarding the development of DDBMs combined with the lack of established practices for implementing data-based products within this industry to be a non-trivial research gap to be explored.

3. Research approach

The study follows a qualitative approach: a single-unit case study was conducted in an FM company of multinational scope, headquartered in Poland. Poland constitutes an economy that transitioned toward market-driven by abruptly discontinuing central planning at the expense of a temporary economic collapse and the necessity to build its external presence from scratch. The company selected for the study, SESCOM Group, is one of the few enterprises representing the FM industry that openly voice the desire to reach data-driven status and take specific actions to do so. With over a decade-long experience, the company focuses on its proficiency in delivering reliable building maintenance, energy efficiency

management and technical service solutions to its European business partners. Moreover, it constitutes the lone FM company in Poland that is a beneficiary of a grant directed at developing an analytical platform, thus blending into the essence of the research approach selected. As a part of the Horizon 2020 program, SESCOM has performed a feasibility study for the *SES-BI – business intelligence platform for energy saving and smart facility management* projects. Following its conclusions, to extend the company's offerings for data management, analytics and delivering energy efficiency-targeted solutions, the as-is BM must be changed from service-driven to data-driven.

As pointed out by Yin (2017), the case study method features a thorough investigation of a contemporary phenomenon within its real-life context through empirical research, and single-case designs assign them roles in applying, testing or building theory. As we were not longing for generalization outside the FM industry and attempted to trace a potential path of innovation for other companies within this industry, we took advantage of single-case design benefits – just to mention its ability to fine-tune the level of detail to a particular case (Eisenhardt and Graebner, 2007) and capability to assign sufficient observation time to study a complex case in-depth (comp. Gerring, 2004). Because of the aforementioned benefits, single-unit case studies were successfully applied to shed a light on typical or extreme cases in both corporate (Molka-Danielsen *et al.*, 2017) and national (Gunawong and Gao, 2017) contexts, which strongly affect our study. Figure 1 shows the line of research that has been adopted and carried out successfully.

To gather viable research data, we carried out a series of three workshops that lasted approximately 6 h, at weekly intervals. Six members of the company's top-level management were involved in the process. Each participant held the position of director with at least 24 months of experience in the position and represented a different area of business, as presented in Table 1. Every workshop engaged a pair of researchers. One interviewer was tasked with the dialog itself, whereas the other was responsible for detecting missing feedback or redundant content on-the-fly. After each question, the roles were reversed. Subsequently, the transcripts were coded using NVivo: a software tool supporting qualitative studies. The open coding process was used with a per-paragraph level of detail (Böhm, 2004).

The first workshop enabled us to capture as-is BM of SESCOM Group and later explore its limits and opportunities in terms of introducing data-based products. To ensure adequate research rigor, the structured content of the first workshop was allocated to nine research nodes as defined by Osterwalder and Pigneur (2010). The management provided the research team with two vital secondary sources: a feasibility study (internal assessment of
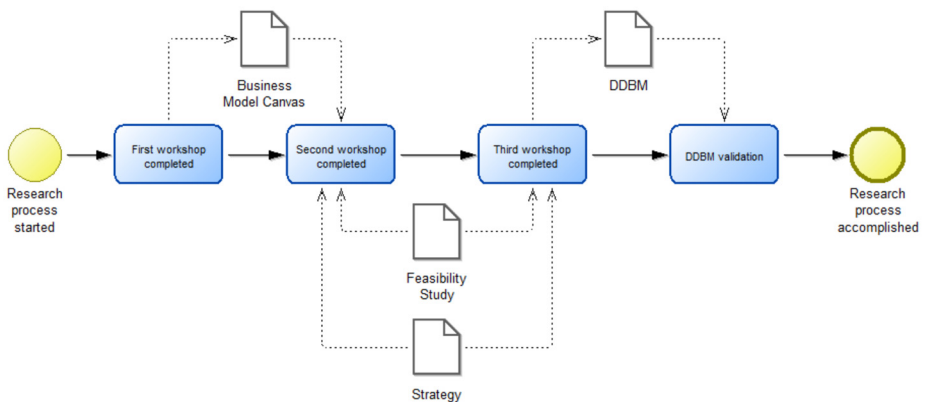

Figure 1.
Line of research

Business area	Primary responsibilities
Marketing director	• Market analysis and trend prediction • Brand development • Maintaining the overall image of an organization • Preparing marketing campaigns • Organizing events • Putting communication and marketing strategies in place
Sales department director	• Assessing margins and sale volumes for individual products and services • Identifying the business needs of the customer base • Supervision over the achievement of sales targets • Conducting sales negotiations
Operating department director (Poland)	• Ensuring efficient and safe working environment • Monitoring quality of service indicators
Operating department director (Europe)	• Enforcing legal requirements, standards, policies and best practices • Managing day-to-day FM operations
IT department director	• Aligning IT strategy with business goals of an organization • Planning, building, maintaining and overhauling IT infrastructure • Managing software development projects • Ensuring availability and security of IT services • Integrating both in-house and external IT solutions
Finance department director	• Financial planning and fundraising • Managing budget utilization • Enforcing accounting policies and conducting internal audits • Carrying out feasibility studies and improving returns on investments

Table 1.
Participants of the
workshops

the potential for collecting and analyzing data in the organization) and a detailed description of the company's strategy. These were used across the second/third workshop.

The current BM canvas of SESCOM Group established as a result of the first workshop was thoroughly discussed during the second workshop. The managers have assessed it and proposed minor enhancements. Brainstorming that captured advantages and disadvantages of the as-is BM directly translated to developing the DDBM.

To elaborate on the DDBM, the third workshop featured approaching the participants with a questionnaire covering six open-ended questions (Brownlow *et al.*, 2015):

(1) What do we want to achieve by using Big Data?

(2) What is our desired offering?

(3) What data do we require and how are we going to acquire it?

(4) In what ways are we going to process and apply this data?

(5) How are we going to monetize it?

(6) What are the barriers to us accomplishing our goal?

The contents of the final workshop were, again, coded. The credibility of the analysis was enhanced through:

• independently coming up with the initial structure of the research nodes by each researcher;

• triangulating feedback with secondary data: internal documents, data analysis project cards from the past, as well as external (customer-bound) and internal (staff-bound) data analysis reports; and

• cross-checking individual steps of the process.

4. Findings

4.1 As-is business model

The BM canvas was used to depict how SESCOM Group generates, delivers and captures value. It consists of nine main building blocks and enables increasing the understanding of how a given business operates. The building blocks – customer segments, value proposition, customer relationships, channels, key activities, key resources, key partners, cost structure and revenue streams – may be allocated to three business areas, as presented in Figure 2.

First of the building blocks under analysis, i.e. customer segments determine various classes of retail organizations that SESCOM aspires to reach and serve. We distinguish six customer segments, as they require different types of relationships and they are keen on paying for distinct aspects of the offering, namely, supermarkets, small shops, bank branches, offices, base receiver stations for mobile operators and petrol stations. It is having a network of facilities across Poland (in many cases – across other European countries as well) that is the common feature of these customers.

In turn, the value proposition represents the portfolio of services provided by the SESCOM that creates value for a given customer segment. For supermarkets, the company offers a comprehensive FM service that includes caretaking of entire buildings, various installations and systems. Other customers do not require such a comprehensive offer and limit requested FM activities to IT services, maintenance of hardware classified as heating, ventilation, air conditioning and refrigeration (HVACR), as well as minor repair work (e.g. repairing furniture, replacing light sources or painting rooms). Common quantitative VPs include consolidated knowledge (collection, analysis and interpretation of data aimed at controlling processes, costs and revenue planning), response times in line with service level agreements, efficient use of resources, allocating funds for increasing business efficiency, technical support provided in 24/7 mode.

Types of relationships that SESCOM gets into with certain customer segments are described by the customer relationships of the BM canvas. For each segment, we identified personalized relationships (each client is approached individually by the contract manager) and automated interactions through the SES support platform (the proprietary IT solution that supports managing service processes). SESCOM's strategy is focused on building long-term relations with customers based on personal and IT-supported channels.

Another building block, i.e. channels, depicts how the company reaches and communicates with its customer segments to deliver the value proposition. The preferred contact channel is built around the SES Support platform – which in this case acts as an IT tool that aggregates information about processes. Customers use a web browser to initiate processes and to observe their progress. To facilitate contact with customers, SESCOM Group has developed a mobile version of the platform. While the SES Support enables building relationships at the operational level, the group delivers industry content through mailing, corporate website, newsletter and content-related whitepapers. There are also some activities undertaken, aimed at building direct relationships, e.g. sales activities, conferences and seminars.

What happens in the organization?	Customer Segments (**CS**), Value Proposition (**VP**), Customer Relationships (**CR**), Channels (**CH**)
How does this happen in the organization?	Key Activities (**KA**), Key Resources (**KR**), Key Partners (**KP**)
How do the money come in and out of the organization?	Cost Structure (**CS**), Revenue Streams (**RS**)

Figure 2.
Canvas BM framework

Main actions a company must undertake to make its BM work constitute key activities. To reach markets, as well as create and offer value propositions, SESCOM builds and maintains relationships with customers. Key is direct meetings with the clients on different levels, namely, technical, organizational, sales and strategy. Moreover, the company constantly monitors global and European trends in the FM industry, namely, technologies, product development and organizational challenges. To advance its BM, SESCOM executes research and development (R&D) projects and constructs prototypes of analytical tools. To generate revenue, the company constantly pursues its core FM processes.

In turn, key resources describe the main assets within a company that makes a BM work. SESCOM divides its key resources into four parts:

(1) physical resources (computer hardware and software, vehicles, office equipment, tools);

(2) intellectual resources (brands, partnerships, proprietary knowledge, years of experience and know-how);

(3) human resources; and

(4) financial resources.

Two proprietary IT platforms are of particular importance: the SES Support (to manage FM processes) and the SES Control (to manage energy efficiency).

The key partnerships building block delineates the network of partners and suppliers that are key to maintaining the BM. Over a decade, the group has established a grid of technical partners – who, throughout entire Europe, provided services and maintenance tasks. Key partners include suppliers of spare and consumable parts for devices (e.g. HVACR systems) as well. Within IT/R&D projects, the company cooperates with start-ups and involves external experts who represent various professions and specializations (e.g. data scientists, lawyers and digital designers) to a considerable degree.

BM canvas's cost structure generalizes total costs incurred to operate a BM – for example, pertained to creating/delivering value, perpetuating customer relationships, generating revenue and focusing on long-term customer relationships. In SESCOM, cost structures can be divided into fixed costs (monthly salaries, rent for office spaces, license fees) and operational costs – OPEX (electricity bills, expenditure regarding maintenance of machinery/cars/tools, marketing).

Finally, revenue streams describe in what way a company shall generate cash flows from each customer segment. The revenue stream has to take into account how much customers will be willing to pay for the value the company delivers. The company has a single revenue stream that bundles recurring revenues from on-going payments. It includes revenues from property maintenance, energy efficiency management and providing basic data analytics to customers.

4.2 Deficiencies of the as-is business model
Reflection on the BM canvas and the feasibility study disclosed that the company had access to multiple data sources indeed, but was unable to facilitate data products in terms of an added value:

> We collect data from many sources. We collect them in IT systems, but we are not able to successfully process them and use the acquired knowledge (IT Department Director).

As-are commercial offerings do not include mature data products; key activities still required unique selling propositions design:

Conclusions and recommendations from processed data should constitute a separate revenue stream for the company (Sales Department Director).

SESCOM pinpointed many factors that have a disruptive effect on the core processes of most FM companies. Those include, but are not limited to, rising costs, declining revenues, competitive pressure – but also increasing customer requirements in terms of counseling, data analysis services behind maintenance, access to information, costs forecasting, designing FM key performance indicators and budget monitoring:

Our clients not only expect technical work to be carried out in commercial facilities – they expect advice, recommendations, support in budget planning, as well as predicting equipment failure rates and forecasting electricity consumption. This is difficult to achieve without analyzing the data (Operational Directors).

Ultimately, it can be safely said that activities effectuated throughout the early stages of the current study went beyond increasing the awareness of top-level management regarding the impact that digital change has on traditional BMs. Company-specific barriers and facilitators readjusted during the second workshop paved the way to elaborating and fine-tuning the DDBM blueprint for the FM industry.
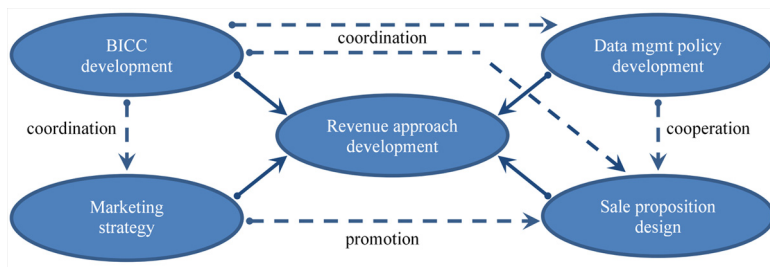
4.3 SESCOM's data-driven business model

Based on the feedback collected during the last workshop, the DDBM blueprint was delivered. Thus, a platform that stimulates SESCOM to become data-driven was established. The DDBM was put into practice and remains a subject of continuous improvement and fine-tuning based on validations. Figure 3 introduces an abstract representation of the integrated DDBM framework, the components of which are further elaborated in Table 2.

SESCOM's DDBM is based on the conviction that data products take traditional FM to a higher level and thereby increase the revenues of the company affected by it. DDBM integrates five high-level components. Four of them (*sale proposition design, data management policy development, marketing strategy development* and *BICC development*) directly shape the data-based *revenue approach development* (solid line). At the same time, soft interactions (i.e. coordination, cooperation, promotion) take place among the four influencing factors. Therefore, the dashed lines point out what specific actions occur between these nodes.

Both the development of new commercial offers and making the existing ones more attractive is required:

We have to present the processed data reports, conclusions and recommendations as our flagship product, as a mechanism necessary for effective (Marketing Department Director).

Figure 3.
Overview of
SESCOM's DDBM

Model component	Model component description	Relations with other nodes	Remarks and inhibitors
Sale proposition design	SESCOM perceives data-based products as a novel class of services delivered to customers – fueled by multi-determinant analytics, profound business domain knowledge and scalable IT architectures. Key and measurable business values that might be provided with the assistance of data services include reduction of power consumption, its costs, streamlining overall FM process costs and optimization of a budget for investment. Analytical products can be categorized in accordance with reference models (Brownlow *et al.*, 2015): 1. Descriptive (*what has happened?*) – reports and KPIs based on history; 2. Predictive (*what could happen?* – predictive models, forecasting); 3. Prescriptive (*what should happen?* – simulations)	Data products demand marketing support to promote sale propositions, which were established in accordance with data management policy . At a certain DDBM maturity level, the sales department was included in BICC's operational activity to master data products and monetize them	Delivering data products means providing them on-demand, permanently, with scalability and security accounted for. Rather than e-mail attachments (e.g. Excel spreadsheets), customers prefer interfacing via a dedicated application or a Web interface. Entire service is many a time established on platforms and applications that rely on a cloud-based infrastructure. While SESCOM is, generally speaking, not a software company, currently it is forced to act like software companies when delivering data products
Revenue approach development	The company initiated the process of developing a BI solution and providing data products. Four revenue models are considered: 1. Customers cover a subscription price periodically to gain access to data-based products. A list of data products provided is set up in advance 2. On-demand subscription that relies on a customer to subscribe to a given product on an "ad-hoc" basis 3. Software licensing – customers use raw data to create/tailor products on their own, using the BI tool provided by SESCOM	The revenue approach seizes all DDBM dimensions. Any change in these dimensions can affect the revenue	Each benefit mode can depend on: • The number of facilities under maintenance; • The number and complexity of data products; • Other conditions agreed upon in the contract, where data products are becoming the FM service package Some customers expect remuneration based on the following criteria: • Level of commercial success achieved, e.g. success fee dependent on a reduction in power consumption as the result of consulting provided and introduced;

(continued)

Table 2.
SESCOM's DDBM
components

Table 2.

Model component	Model component description	Relations with other nodes	Remarks and inhibitors
	4. Experts used by the company analyze data and charge customers for consulting based on a lump sum (fixed amount for the entire venture) or reimbursable (per hour consulting fees) contracts		• The accomplishment of specific projects
Data management policy development	The company operates in over 30 000 facilities in Europe. A dedicated IT solution – SES Support – captures operational data (detailed service processes data). An integrated energy efficiency solution – SES Control – records multiple attributes (power consumption in stores, temperatures, carbon dioxide concentration). There are also other data sources: e-mails, flat files, notes, reports written on sheets of paper, other IT systems While BI maturity achieved to date by the company is still on a low to medium level, data management policy needs to be developed comprehensively: 1. Data sources identification/classification; 2. Detailed strategy for data acquisition, processing and aggregation with particular emphasis on data security and privacy; 3. Building an advanced analytic model, then developing a revenue approach and data product delivery modes through IT staff collaborative work with Sale and Marketing departments; 4. Continuous data product improvement in response to fluctuations in customer needs, legal requirements and economic environment;	Data management policy stimulates sale proposition design as it includes data product improvement. It generally involves IT and R&D staff who are assigned to the BICC	• Based on the feasibility study performed, Apache Hadoop is considered the optimal technology solution to fulfill the technical requirements of the SES-BI project. Criteria of implementation time/cost, project scalability potential, the complexity of the target solution and market potential of the solution were taken into account. Hadoop includes applications to collect, arrange, integrate, process and visualize data in accordance with the analytical model • Data security and privacy are considered by data privacy legislation in different countries

Model component	Model component description	Relations with other nodes	Remarks and inhibitors
	5. Continuous development of data product prototype (R&D activity)		
Marketing strategy development	Marketing strategy includes activities to promote, place and price a data product	Strong cooperation with the sales department	Examples of marketing activities include publishing newsletters, whitepapers and articles on the internet, trade fairs and product placement in entertainment
BICC development	Setting up the DDBM requires a new combination of skills and redefining the organizational framework of the entire company. SESCOM's BICC is a cross-functional team with specific tasks, roles, responsibilities and processes for supporting and promoting effective use of business intelligence across organizations. The team is responsible for DDBM development, data management policy development and building an organizational culture to facilitate deployment of BI services throughout the entire value chain (from suppliers, subcontractors and SESCOM to business customers and end-users). BICC features both business and IT skills. In the company under research, BICC is developed in parallel with the SES-BI project	BICC oversees the development of DDBM. It coordinates all DDBM dimensions and has an influence on the company's revenue model	DDBM approach requires recruiting data talent and managing it effectively BICC includes R&D representative/team to identify gaps in FM analytics, to introduce BI innovation, to provide assistance in designing unique selling propositions, data services, KPIs, algorithms and to help with evaluation BICC cooperates with the HR department to develop a skills matrix, to identify training needs and to ensure staff capability improvement

Table 2.

The role of marketing and sales is to convince the customers of the company that every process may be considered a "data-driven decision-making" measure in formulating an FM approach. Key questions regarding facility maintenance, budget planning and reducing power consumption generally require inter-departmental data sources and joint effort of individual departments in posing hypotheses and mapping activities via algorithms. It is crucial to ensure that customers benefit from the proposed innovation if SESCOM wants to truly introduce digital change and develop the DDBM.

5. Validation of the data-driven business model

The DDBM blueprint was field-tested during the implementation of the contract signed with a corporate customer that runs its business globally. The customer owns service/commercial buildings around the world, several dozen of which are located in Poland. The customer enlisted support in data analysis from multiple sources. In particular, substantial support in managing energy efficiency was required, and the main goal of putting the components of DDBM into work from the customer's point of view was to reduce the overall cost of electricity consumption across facilities. SESCOM wanted to check whether the DDBM can deliver developing and implementing efficacious recommendations to reduce electricity consumption. SESCOM created a marketable data analysis/processing product from this consultancy.

Negotiations with the customer enabled the group to gain full access to data sources required to fulfill the contract (just to mention sensor data, invoice data, weather data, number of transactions, building surfaces/volumes) and to include all DDBM components in this contract. As a consequence, a layer of detail shown in Table 3 was added to the individual components of the model and it was confirmed that the specific determinants on the customer's side did not affect the relationships between the model nodes.

For the purposes of analyzing feedback on the implementation of the contract, the research team was provided with access to minutes of meetings, working notes and non-financial contractual details. A single researcher was delegated to participate in selected internal meetings. The validation revealed that SESCOM ought to streamline the operation of its new BM with respect to its sales department performance, public relations and marketing performance. Non-technical staff needs to understand products made possible by DDBM and promote them more effectively. IT tools – both dedicated to collecting data and processing it – require constant improvement. Possible IT infrastructure extensions are being analyzed, and new predictive algorithms are accounted for. Additionally, the management of the company feels that the Business Intelligence Competency Center is lacking a Facility Manager, who could interpret certain data concerning the condition and construction of buildings, as well as individual systems and hardware.

The customer itself took advantage of the products delivered (analyzes and reports) and began implementing recommendations by launching a savings program scheduled to last for three years. Feedback gathered to date points at the legitimacy of adopting the revenue approach in place through introducing shares in the savings generated in exchange for a reduction in the subscription fee.

6. Implications and limitations

Our research confirms that Big Data can indeed be considered a resource with a real potential to drive the radical business transformation within a given industry in the contemporary entrepreneurial landscape. Companies develop new BMs in hopes of generating additional business value through extraction, refinement and ultimately monetizing data (Hartmann *et al.*, 2016). While related studies discuss DDBMs in distinct

Model component	Model component description	Relations with other nodes	Remarks and inhibitors
Sale proposition design	1. Descriptive analytics-based products: • Weekly reports on consumption broken into individual facilities; • Monthly reports; • Holiday reports (consumption during off-periods of facilities to check whether device schedules are working well); • Savings reports (record sheets of power consumption figures in comparable periods, e.g. week to week, current month to preceding month); • Comparison of actual consumption (measured) with entries of invoices issued by electric power suppliers. 2. Predictive analytics-based products: • Monthly consumption forecasts. 3. Prescriptive analytics-based products: • Analyzes of the items listed above; should a suggestion of changing the tariff come up, simulations of future power consumption accompanying possible tariffs shall be performed	In this case, the information regarding the opportunity to support the analytics reached the target customer without launching a marketing campaign – the customer announced an award of contracts by tenders for data processing services, which SESCOM won	For the purpose of the tender announced by the customer, data products were described by the customer in the form of the demand for specific reports. This was bidding information. The final list of products was developed through joint workshops during which the descriptive, predictive and prescriptive components were identified
Revenue approach development	Customer pays a monthly subscription fee to gain access to data products. This fee covers the consultancy of the company's data analysts as well	The revenue approach seizes all DDBM dimensions. Any change in these dimensions can affect the revenue	The lump-sum was affected exclusively by: • The number of facilities under maintenance; • The number and complexity of data products
Data management policy development	The following were agreed upon: 1. Data sources: • Measurements of power consumption in individual facilities; • Invoices regarding an electric power supply; • Contracts with energy suppliers; • Technical parameters of buildings	Data management policy was developed in parallel to the sale proposition design (i.e. along with defining and cataloging of services). The policy takes into account the security and confidentiality of data	Principles of operation regarding telemetry and IT systems that process data (and are owned by SESCOM) constitute a vital component of this policy. The customer gained the required access to IT solutions, was familiarized with their operation and

(continued)

Table 3.
Validation of the reference DDBM blueprint – adaptation to an actual contract

Table 3.

Model component	Model component description	Relations with other nodes	Remarks and inhibitors
	(narrowed down to those that affect power consumption); • Schedules of facilities operation; • Record sheets and parameters (both technical and work schedules) of electrical devices; 2. Rules for accessing data sources; 3. Frequency of collecting individual data streams; 4. Product delivery channels (via email/dedicated platform)		activities related to handling target data products
Marketing strategy development	Marketing content is being prepared on promoting the activities put into action, as well as the benefits gained by the customer from analytics and acquired knowledge	The strategy for pricing data-based products, cataloging them for marketing purposes and putting into detail for commercial purposes is being pinpointed	White papers describing the execution of this contract are being elaborated
BICC development	Structure of the BICC team proposed by the company under research involves the customer's facility manager and contractor's representatives: • Data analyst/energy manager; • Database and data warehouse expert; • Software developer; • Sales representative; • Marketing representative	The participation of the sales and marketing representatives ensures monitoring the implementation of the offering to continuously improve it, as well as to generate external communication regarding data products that SESCOM can deliver	Demand exists for further roles in the BICC team, which should materialize to support contract execution and development of new offering components: • An R&D expert or team; • Domain experts (electricians, hardware-related professionals, construction workers); • A project manager (for handling overall contract execution)

business areas (Zaki *et al.*, 2015; Smith *et al.*, 2015) that typically are based on similar frameworks (Brownlow *et al.*, 2015; Hartmann *et al.*, 2016), this contribution takes advantage of high volumes of operational and sensor-based data collected by FM companies (Gawin and Marcinkowski, 2017b). The availability of such data unleashes BMI potential within the FM industry by providing an added value. This value is manifested in terms of brand-new data-based products, which enable decreasing property utilization costs, limiting energy waste and finally deliver more sustainable working environments for customers who to-date were confined to traditional FM services. Thus, Big Data's 4 V specificity has been successfully supplemented with the fifth V that was postulated across academic contributions and reports: value.

The trends acknowledged by internationally-recognized FM organizations, the potential of data-based products recognized by the European Commission, as well as the positive feedback from the DDBM validation indicate that companies must be able to identify, develop and continuously improve four areas: sale proposition, revenue approach, data management policy and marketing strategy for data products. On top of that, the BICC must have a muscle to transform the business, so that data product development/delivery became a relevant factor in the company's vision and long-term strategy as mainstream for designing value proposition and generating revenue. Finally, a common strategy, integrated approach, organizational transformation and cooperation among DDBM areas are needed to capture and synchronize DDBM growth. Our research extends the contribution of Hartmann *et al.* (2016) by including marketing, promotional and competency elements focused on the production and delivery of data-based products. Following Cheah and Wang's (2017) argumentation that companies must find suitable BMI paths for their development, we indicate the organizational areas that could implement the innovation process of the BM.

The research also contributes to managerial practice. By using the DDBM blueprint, any FM company may follow a step-by-step reference process to build its own DDBM around resources, skills and specific settings within which it operates. Of course, this will not all happen in a single day. Those skills, tools and insights take time and effort to build. To avoid the common trap of DDBM development, managers ought to ensure the alignment of BMI initiatives with the mission of the company. Contracts built around the DDBM proved to be satisfactory for both the company its customers. Applying the DDBM supported several adjustments on the customer side, which led to more efficient and sustainable business expansion patterns. BMI effort discussed in the study comes with an important lesson for enterprises that contemplate establishing their distinctive data product portfolio. Abating traditional methods of remuneration and advertising channels was instrumental in reducing customers' initial costs while maximizing long-term business gains. Relying more on a commission-based revenue approach and preparing an optimal setting for word-of-mouth marketing – which is a natural consequence of successful recommendation-driven projects – ought to be considered instead.

As with any research, some limitations should be considered. To begin with, even companies within FM have slightly different technological capabilities regarding the provision of data-based products. Thus, replicating the workshops throughout industry leaders in various countries could unveil interesting product options and establish a base for comparing developed and emerging/transition economies. Second, acquired knowledge cannot be directly generalized outside FM. High reliance on telemetry and distinctive synergy opportunities in our opinion justify classifying companies representing this industry as extreme cases. Future work features monitoring and tailoring the DDBM blueprint in the real-world setting. Simultaneously, we consider conducting extended research to identify detailed steps to move from a traditional to a data-driven BM in an FM company.

7. Conclusion

The study clearly positioned Big Data as an enabling factor for evolving a service-based BM in place toward a data-driven one. Data-based products are designed to effectively solve perpetual FM problems – such as monitoring power consumption and tracking the lifecycles of devices, systems and buildings – while emphasizing preventive measures at the expense of reactive ones. Because of Big Data in FM, potential issues and inefficiencies might be pinpointed with much greater accuracy and addressed beforehand.

Moreover, the authors established and validated a DDBM framework for SESCOM. We conducted three workshops with top-level managers of the company to provide synergy with a large volume of information that originated from a feasibility study of the BI solution, which was accomplished in the company during a four-month-long period. We built upon the as-is BM of the SESCOM Group that revealed it as a strictly service-oriented company. To address the constraints of the phased-out BM, we proposed five components of DDBM: sale proposition design, revenue approach development, data management policy development, marketing strategy and BICC development. We noticed two innovations in our approach: the significant role of BICC and relationships between model elements. While, usually, the responsibility for data management strategy lies with CDO (Chief Data Officer) as the person at the forefront of an organization's shift toward a data-driven business, our research highlighted the importance of BICC assembled from staff representing the departments in different corporate units. As a multidisciplinary group, BICC manages the BI development project. Analytical competencies evolve as the DDBM matures.

Our research explored strategic issues in the organization and revealed a few elements behind DDBM development. The BMI venture went beyond the well-established scope, additionally featuring marketing, promotional and competency elements focused on generating and delivering data-based products. We highlighted the key role of a BICC within BMI and indicated the organizational areas that could take the greatest advantage of innovating business activity. On top of that, we provided a viable DDBM blueprint for an FM company and drafted the way to get from service- to data-driven business.

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