



Exploring API-driven business models: Lessons learned from Amadeus's digital transformation

Saeid Heshmatisafa, Marko Seppänen*

Unit of Information and Knowledge Management, Faculty of Management and Business, Tampere University, Finland

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ABSTRACT

Digital transformation compels companies to seek new strategies and business models, allowing firms to find new ways to create and capture value. APIs have been widely used in improving internal processes and have been opened up recently to third-party developers to enable innovations in digital ecosystems. However, few studies have documented success stories of value generation through employing public APIs and thus enabling new, API-driven business models. This single case study examined the digital transformation in one of the leading organizations of the travel industry, Amadeus Corporation. Publicly available documents and other gray literature were used as data for content analysis. The results show how Amadeus has transformed its business model into an API-driven business model. This study contributes to the literature on API-driven business models by demonstrating the implication of APIs as a strategic tool in value co-creation. We identified six different values that were generated by exposing digital assets to API consumers through the API-driven business models of self-service platforms: commercialization, ecosystem, big data, market and marketplace, entrepreneurship, and R&D.

1. Introduction

Implementing a firm's strategy is usually associated with an investment in technological and digital innovation (Porter, 1985). Digital transformation (DT) has become a strategic imperative on leadership agendas, forcing companies to seek new strategies and business models (BMs). Horlach et al. define DT as the tactical and strategic efforts that are triggered by digital technologies in an attempt to find new ways to capture value (2017). In recent years, scholars have argued that the building blocks of DT are the prominence of boundary resources, one of them being application programming interfaces (APIs) (Huhtamäki, Basole, Still, Russell, & Seppänen, 2017; Polydoropoulou et al., 2020). Initially, APIs were considered to be in the domain of developers, who aimed to accelerate delivery and advance the robustness and quality of the digital infrastructure (Koutsopoulou, Kaloxylou, Alonistioti, & Merakos, 2007). Currently, APIs enable third-party users to innovate within digital platform ecosystems while allowing API providers to obtain substantial business advantages (Heshmatisafa & Seppänen, 2020).

An API call is a request submitted to retrieve information from the server and deliver it to a client solution. The call also includes everything that happens after the request is submitted. Typically, requests are authenticated using an API key, a unique identifier linked to the

contractual arrangement. In this way, API providers can compile and aggregate data from each consumption, thus enabling the development of new offerings based on this data. Consequently, it can be argued that APIs, particularly public APIs, affect businesses at the strategic level and are not just gateways and technical artifacts.

To date, several studies have explored the generic value creation of API-driven DT (e.g., Bonardi, Brioschi, Fuggetta, Verga, & Zuccalà, 2016; Horkoff et al., 2018; Jacobson, Brail, & Woods, 2012; Wulf & Blohm, 2020); however, very few scholars have covered the offering of multiple APIs in empirical settings. Most studies have merely focused on data monetization (e.g., Wixom, 2014; Wixom & Ross, 2015; Wixom & Ross, 2017) or the pricing strategies of APIs (e.g., Unsal, Oztekin, Cavus, and Ozdemir, 2020). More importantly, the adaptation of an API does not always bring value for the adaptors. Subsequently, companies benefit by examining business settings and looking at the nature of values in order to make robust decisions regarding the feasibility and usefulness of a technology adaptation.

Accordingly, the present study attempts to shed light on the value creation mechanisms in API-driven BMs within a single case company. In API-driven businesses, the primary driver behind exposing intellectual property is the exploitation of potential rewards. For example, the incumbents in the travel industry are increasingly digitalizing and

* Corresponding author at: Tampere University, Korkeakoulunkatu 10, 33720 Tampere, Finland.

E-mail addresses: saeid.heshmatisafa@tuni.fi (S. Heshmatisafa), marko.seppanen@tuni.fi (M. Seppänen).

modularizing their products and offerings. The selected company, Amadeus, is one of the leading travel technology companies and has undergone a significant transformation into an API-driven business in recent years. Additionally, the travel industry is at the forefront of digital innovation and is destined to be transformed by new technologies in almost every aspect of its operations. Thus, we believe that investigating the API-driven BMs in Amadeus yields valuable insights into API-driven BMs and associated benefits. Therefore, the research question was formulated as follows:

Why did Amadeus transform its BM toward an API-driven BM, and what have been the associated business values for this company?

The current paper is structured as follows: The theoretical background is given in Section 2, and the methodology and data collection used are described in Section 3. Section 4 is devoted to the outcome of the content analysis of the collected data. Finally, the conclusions and limitations of the study are discussed in Section 5.

2. Theoretical background

This section starts with an overview of the information systems literature on DT and APIs, as well as their linkage. There is also a discussion on the lack of clarity concerning the concept and classification of APIs. In total, we have gathered 74 papers published since 2012 in established scientific electronic databases such as ScienceDirect, IEEE Xplore, Scopus, Web of Science, and ACM DL (Falagas, Pitsouni, Malietzis, & Pappas, 2008; Gusenbauer & Haddaway, 2020).

We included articles in English that used the following keywords: “application programming interface*,” “API*,” “API-driven,” or “API-based,” and “digital transformation,” “business model*,” and “value creation.” The results were filtered to include papers in the management and business fields only. Out of the 74 papers, 12 articles were duplicates. Afterwards, the relevance of the gathered articles was analyzed by the title, keywords, and abstract. Moreover, we added more papers on the value of API-driven products by applying backward and forward searches. The search results are shown in Table 1. In the following sections, we discuss the main concepts from a representative sample of 30 of the retrieved papers. The concepts derived from the literature, such as “API monetization,” “API platform,” and “API innovation,” were used in the coding process.

2.1. Digital transformation and business models

DT has become an increasingly crucial phenomenon among scholars and experts. Practitioners and scholars alike believe that organizations must exploit digital technologies to innovate and establish strategies that can support the implementation of DT and, ultimately, enhance operational performance (Matt, Hess, & Benlian, 2015). The definitions of DT differ extensively across disciplines. In the present study, we refer to DT as the increasing effort in organizations to implement digital technologies and transform traditional processes (Kohli & Melville, 2019; Kraus et al., 2022).

Some scholars have argued that digital technologies are disruptive by nature (Karimi & Walter, 2015). They alter the competitive landscape, accelerate the convergence of existing products and services to shape new digital solutions, and, ultimately, enable data accumulation for future offerings (Porter & Heppelmann, 2014; Vial, 2019). Nonetheless, they do not disrupt BMs; it is what firms decide to do with new technologies that is enabling or disruptive.

Table 1
Search results in ScienceDirect, IEEE, WOS, Scopus, and ACM (2012–2022).

Year/Database	ScienceDirect	IEEE Xplore	WOS	ACM DL	Scopus
2010–2022	9	13	20	5	19
Final selection	2	4	12	1	11

DT allows for the reshaping of BM components such as value propositions, value networks, and channels (Vial, 2019). The influence of DT and digital technologies on BMs can be categorized into three broad groups: automation, extension, and transformation (Feng, 2007; Lindgardt, Reeves, Stalk Jr., & Deimler, 2012). When a company uses DT to automate or improve existing products and services, such as facilitating communications, this is referred to as automation. The term extension refers to situations in which a company uses DT to endorse new ways of doing business that complement, rather than replace, existing products and services. Transformation refers to situations in which DT is used to enable totally new BMs.

In addition, DT encourages the development of multiple BMs to consolidate resources and activities while maintaining a competitive advantage (Li, 2020). However, technology is not the only force that helps companies remain competitive and generate new methods of value creation. Appropriate strategies are required to capture the full potential of DT implementation. In this respect, the open innovation phenomenon highlights the importance of business model portfolios and digital platforms in coordinating the complex yet close interactions among the parties of a value network. Ultimately, at a high level, they provide the “ability to detect opportunities for innovation and seize those competitive market opportunities by assembling the requisite assets, knowledge, and relationships with speed and surprise” (Sambamurthy & Grover., 2003, p. 245).

2.2. The rise of digital platforms

Over the past few decades, the advent of digital platforms has replaced the traditional pipeline BM and introduced a flatter, more inclusive, and more innovation-centered approach to value creation (Gawer, 2011). A digital platform often exploits recent technologies to connect different resources, people, and organizations in a centralized way to exchange value and create new value (Parker, Van Alstyne, & Choudary, 2016). These digital platforms establish a multisided market to simplify value creation between consumers and external producers (Rochet & Tirole, 2006). In addition, building such a digital platform creates economic value for both the suppliers and the users of the service (Huhtamäki et al., 2017).

Digital platforms are “editable” and “reprogrammable”. By the same token, they are more flexible when it comes to expanding their functionality and embedding complementary modules from third-party developers (de Reuver, Sørensen, & Basole, 2018). Likewise, digital platforms construct infrastructure as a core value proposition that can attract a significant number of firms to create complementary products, services, or technologies, which, as a result, initiate the development of various innovative business ecosystems (Zachariadis & Ozcan, 2016).

Most perspectives represented in the literature highlight how incumbents have nurtured a digital platform to unite the scattered know-how and resources of various firms and connect users with producers. Firms in different sectors use these two principles to develop their digital platforms to benefit from the entire ecosystem of suppliers and users (Tiwana, Konsynski, & Bush, 2010). For instance, Google, a master of creating digital platforms, made the Android platform open source in 2007, offering a \$10 million prize for developers to build novel applications through boundary resources. This brought in more developers while attracting partners such as Samsung.

2.3. Deconstructing APIs

Digital platform ecosystems are primarily empowered by the boundary resources of APIs, allowing firms to share business assets (i.e., products, services, or results) with internal and external complementors to build new, interoperable solutions (Lee & Ha, 2018; Tiwana et al., 2010). An API is a way for two computer applications to communicate with one another over a network using a common bilateral language (Jacobson et al., 2012). In addition, an API acts as a control point where

an array of services is made available to potential users in a controlled and managed way (Heshmatisafa, Huhtamäki, & Seppänen, 2022). Therefore, APIs can be defined as the media that connect users, partners, communities, end users, and developers to business assets (i.e., products, services, and results) to develop innovative solutions (Holley, Antoun, & Arsanjani, 2014). In other words, an API is a cost-effective way to distribute unique features to distinct groups at any time and place in order to yield new opportunities.

APIs can be used internally by sending queries to the server (Sarker & Datta, 2022). Internal APIs facilitate the collaboration and access of information between interconnected services and business processes, improve productivity, and create an omnichannel experience (Zachariadis & Ozcan, 2016). Similarly, APIs can expose business assets to external consumers to reach beyond organizational boundaries and create business value. Such an external API, which is known as an open API, enables the integration of business assets with partners and third-party consumers, leading to cross- and up-selling opportunities.

Open APIs can be differentiated into private and public APIs (Moilanen, Niinioja, Seppänen, & Honkanen, 2019). Private APIs are typically designed for partners and are accessible after contractual agreements have been made. In contrast, public APIs are designed for anyone and are accessible with “little or no contractual arrangement.” Briefly, the reasons behind API adaptation can be classified into 1) improving internal organization processes, 2) structuring information and packaging products, and 3) reaching new and existing markets.

Further, public APIs drive the digital economy and create platform ecosystems in which innovators develop API-consuming applications for a fee. In this sense, the digital economy of API, also called the API economy, means generating economic benefits from APIs (Moilanen et al., 2019). Thus, the API economy is achieved when firms expose business assets via (web/REST) APIs to third parties to gain part of the created value through revenue sharing or other mechanisms.

2.4. API value creation

API products are generally assigned the strategic role of opening up valuable assets by forfeiting the intellectual property of the resource to create business value. Thus, in the present study, the term “business value” refers to a valuable service, product, capital, or piece of information that is exchanged. We divide the business value of APIs into direct or indirect values.

In the direct approach, API usage is turned into monetary value via a transaction, which is also known as API monetization. Several authors have investigated API monetization as an independent subject. De (2017) defined API monetization as charging for additional traffic. Jacobson et al. (2012) described API monetization as billing consumers at regular intervals. However, API value creation does not necessitate a monetary transaction (Hanafizadeh & Harati Nik, 2020). The indirect method converts API-exposed assets into new forms of information, services, or products. This approach enhances the API value to produce something more valuable, such as insight. In this context, non-monetary values are those that cannot be measured financially. Previous studies have focused more on the various types of API monetization strategies, such as free, freemium, or tier (Hanafizadeh, Barkhordari Firouzabadi, & Vu, 2021; Tan, Anderson, & Parker, 2020; Unsal, Oztekin, Cavus, & Ozdemir, 2020) rather than on the monetary and non-monetary business values that are released.

3. Methodology and data

This section provides a brief overview of the selected case study, describing the methods chosen for data collection and analysis.

3.1. Case study method and case description

The purpose of the present study was to investigate the DT

phenomenon in detail; thus, a single case study was selected (Dubois & Gadde, 2002). A single rich case can provide a detailed and finely nuanced view of the different phases and actions that need to take place during BM transformation processes (Siggelkow, 2007).

The reasons for the case selection were twofold: fit and access. Amadeus Corporation is a large multinational firm that has transformed its businesses to embrace an open API-driven way; therefore, the company was highly suitable for analysis. Second, there was access to a plethora of information via plentiful publicly available material and other analyses. We applied a case-based research strategy appropriate for answering “why” or “what” research questions (Yin, 1994).

Amadeus Corporation, a leading global technology provider in the travel industry with over 30 years of experience, provides a topical example of API-driven BMs. As one of the incumbents in the distribution market, Amadeus has maintained its growth by operating in the EMEA region (i.e., Europe, Middle East, and Africa), with an estimated competitive position of 44% of the market share in 2019 (Satalkar, 2017). The company operates in two main complementary and synergistic segments. First, it serves as a distribution platform, offering solutions that enable commerce and transactions between travel providers, travel sellers, and travelers. Second, the company offers IT solutions to improve operations, such as analytics and departure control for travel businesses. The focal core of these two operations is equipped with more than 1000 internal APIs. Moreover, it is worth mentioning that Amadeus earned approximately 6.25 billion U.S. dollars in revenue in 2019. The Amadeus customer experience (Fig. 1) covers the entire travel life cycle of travelers by providing various services, such as destination content, COVID-19 and travel safety, and flight and hotel booking.

3.2. Data collection

Data were collected through extensive desktop searches. The case company has been listed on the Spanish stock exchange since 2010; therefore, it regularly provides information to its shareholders. In addition, publicly listed companies, especially larger ones, attract the attention of several analysts, who also regularly produce different types of reports. Plenty of publicly available information is provided on company websites and in other sources, for example, public presentations, mainly for marketing and other stakeholder communication purposes.

We adopted a longitudinal approach to data collection to identify and understand the evolution of Amadeus’ API-driven BMs over time and to capture the realized business benefits. Data gathering was based on a broad range of publicly available and reliable resources, including archived materials, expert press, academic papers, reports, company documents, financial statements, webpages, and media releases. The accumulated dataset was further extended to focus on business strategy and encompass secondary sources such as the general press (e.g., *Financial Times*, *New York Times*, *The Economist*, etc.), and practice-oriented management publications (e.g., *Harvard Business Review*, *MIT Technology Review*, etc.). Ultimately, we analyzed the content of the acquired information to ensure direct relevance to the research problem. Furthermore, the source of the given evidence was checked using sources such as ProQuest to confirm legitimacy and consistency.

Additionally, the data collection technique consisted of collecting all of Amadeus’ annual reports that were made publicly available, beginning in 2010. This enabled us to construct an essential timeline for the period from 2018 to 2021. The year 2018 was selected because that was the year that Amadeus launched its first public API. The timeline served as a starting point for identifying BMs, BM changes, and growth strategies.

Subsequently, the gathered data were scrutinized and organized to develop a coherent transcription of actions and different phases that took place during the transformation period. Because of the size of the company and its vast number of actions, we focused on API-related

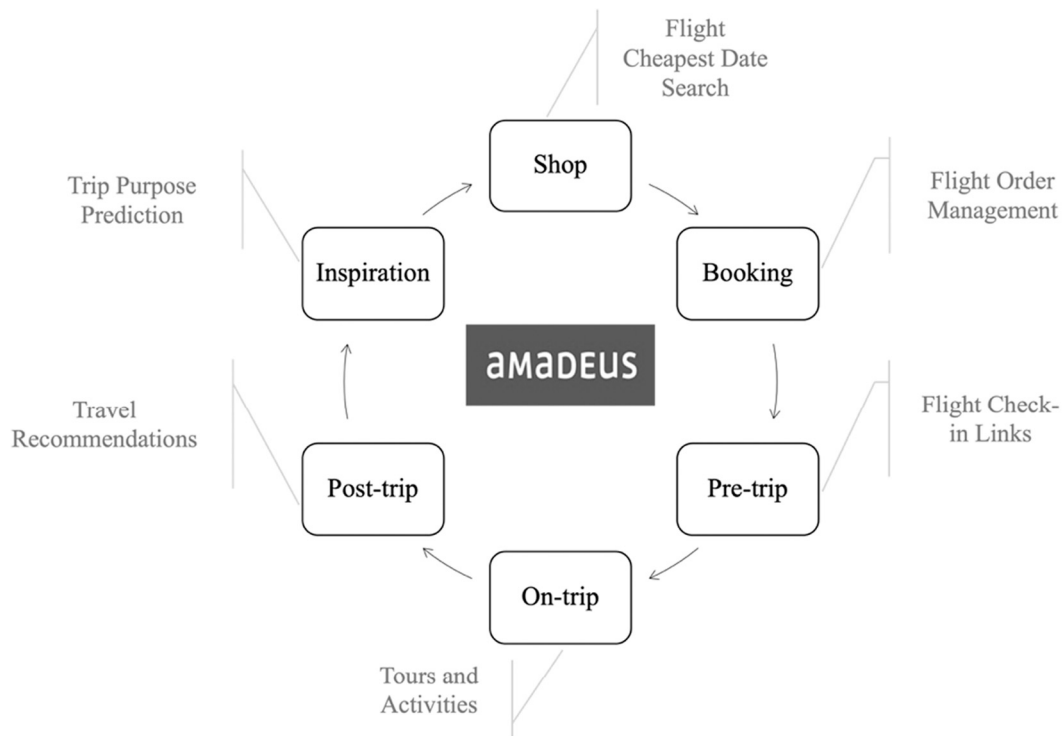


Fig. 1. Amadeus travel life cycle with examples of APIs (Amadeus, 2020b).

matters and how each business segment dealt with API issues. Furthermore, we fine-tuned the accumulated dataset for relevant events and excluded those that did not fuel Amadeus’ API BM growth. The eight excluded documents were mainly tutorial-oriented articles and sponsored content. In addition, repetitive documents related to reports or interviews that contained similar content but had only minor differences. For instance, the acquisition of TravelClick as a major event has been addressed in various news articles and white papers. Ultimately, documents that raised events that occurred before the development of Amadeus’ developers’ program were omitted. The collected primary and secondary data were derived in five steps, as presented in Fig. 2.

In addition, Table 2 provides a descriptive summary of the data collection included in this study. A total of 43 documents were selected according to the process.

Table 2

Final results of data collection from desktop searches.

Description	Results
Case study	3
Report	9
Presentation	2
Scientific paper	2
Book	1
White paper	2
Documentation	2
Online (including official and unofficial)	22
Total	43

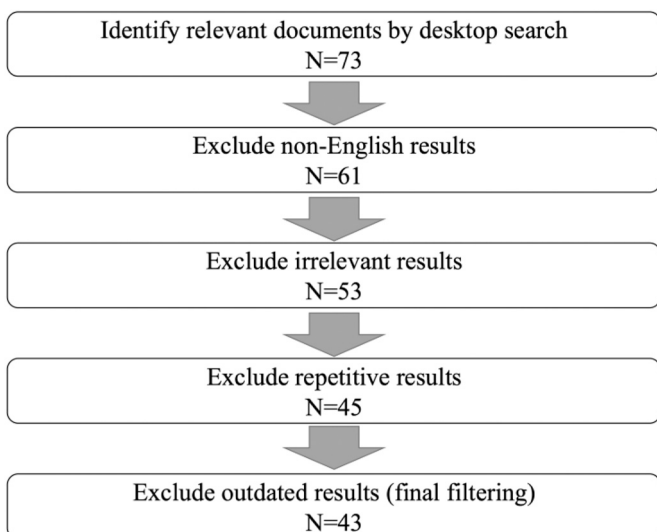


Fig. 2. Data selection process.

3.3. Data analysis

The primary goal of the present study was to investigate the actualized business values of APIs harnessed by BMs through a single case study. The knowledge concerning Amadeus’ strategic practices is fragmented and requires analyses and the synthesis of different events relating to API-driven BMs. Thus, content analysis was regarded as appropriate, given that the data source was in a textual format. We employed a five-step qualitative analytical procedure, as suggested by Thomas (2006): 1) preparation of raw files (data cleaning), 2) close reading of the text, 3) creation of categories, 4) overlapping of coding and uncoded text, and 5) continuing revision and refinement of the category system. During the second step—the close reading of the text—we familiarized ourselves with the data to find common grounds for coding the content. In doing so, we identified text segments related to API-driven BMs. In the third step, we used a hybrid approach of qualitative methods of thematic analysis, which is a combination of deductive and inductive coding. It merged both the deductive a priori template of codes approach outlined by Crabtree and Miller (1992) and the data-driven inductive approach of Boyatzis (1998). This method complemented the research question by integrating the tenets of IS phenomenology to the process of deductive thematic analysis while “giving voice” to the data and allowing themes to emerge directly from the data

using inductive coding. The deductive approach was derived from the literature review and included codes such as “API monetization,” “API platform,” and “API innovation.” The inductive approach originated from the initial reading of the data and included codes such as “API data,” “API acquisitions,” and “API partnerships.” Overall, we used 15 codes which helped us to identify the key events within the text and narrow down the contents into distinct BMs and/or associated changes.

Once Amadeus’ BMs, the basis of the exposed assets, and consumers had been determined, we assigned seven themes from the data and codes in the revision and refinement phase. Following this, both authors discussed redundancy and overlapping themes, resulting in the selection of the final six themes (later categories). For instance, the authors agreed to merge the API market and marketplace because both ultimately signified the same business value. Finally, to refine the findings and minimize possible biases, we cross-checked our preliminary interpretations with input from secondary sources (i.e., case studies, ProQuest articles, and archived quotes). Table 3 provides examples of the final themes based on the text content.

4. Results

This section presents the results of the analysis of the 43 primary documents. The results represent the state of design of the API-driven BMs at Amadeus and are based on the following: (i) the DT journey and (ii) the classification of business values driven by public APIs at Amadeus.

Table 3
Examples of the different types of themes.

Quotes from the textual content	Related codes	Themes
“The program not only tracks venture capital financial performance, but also actively facilitates commercial collaborations and co-marketing among our customers and Amadeus.”	API collaboration	Entrepreneurship
“Amadeus for Developers is part of the three-pronged external approach to innovation at Amadeus that also includes a venture fund investing in start-ups and a strategic partnership program.”	API acquisition, API policy	Entrepreneurship
“These capabilities and assets combined with very close collaboration between our engineering and commercial organizations are critical to maintain Amadeus’ position at the forefront of the travel technology industry.”	API market	Marketplace
“We monitor the market for potential opportunities regularly and may perform acquisitions in the future, if they support the delivery of our strategy and accelerate our time to market.”	API acquisition, API policy, API data, API use, API market information	Big data, Entrepreneurship, Marketplace
“We believe that this is the base of a positive feedback loop: the more data, the more relevant the pattern analysis, in turn feeding back enriched transactions and generating more data, and so on.”	API data, API platform	Big data, Ecosystem

4.1. Digital transformation narratives

The DT taking place at Amadeus stemmed from two areas: digital enhancement and the DT of the BM. The digital enhancement of technology is mainly used to enhance the infrastructure and facilitate communications with customers. Furthermore, the enhancement of digital technologies has been used to extend the traditional B2B BM into an open API-driven BM platform. Fig. 3 summarizes Amadeus’ activities, three of which are marked with a dotted line (external drivers, technologies, and management) and are described in more detail later.

4.1.1. Digital enhancement journey

Back in 2000, Amadeus was the first global distribution system (GDS) to present a structured API. A significant number of APIs (about 1000) fed the plethora of travel actors and players. This ecosystem has maintained Amadeus as a reference source for travel services. An illustrative and generic categorization of the actors and players of the ecosystem is presented in Fig. 4. However, the capabilities were limited mostly by internal resources and expertise in a very complex technical environment leading to slow go-to-market times. The structure of the existing SOAP/XML APIs was only suitable for established actors.

Travel incumbents were taken aback by the ingenuity of small companies and start-ups in crafting new narratives. The travel industry has continuously experienced disruption by players seeking to increase revenue, lower costs, and increase loyalty. The emergence of rising markets, such as online travel agencies, along with the advent of RESTful APIs, increased the market demand for web APIs. This presented a new opportunity for travel providers such as Lufthansa to instigate independent public API initiatives and enter new territories. Moreover, Amadeus realized that the finest ideas and most successful innovations could be derived from early-stage start-ups. Consequently, the company needed to extend the scope of the platform and integrate into complementary markets to stay relevant in the market and manage competition and collaboration.

In response to external drivers and internal needs, Amadeus began to launch a dual platform, Amadeus for Developers. This platform connects different types of complementors to the richest information in the travel industry so they can run, innovate, and launch their applications with faster time-to-market capability. Currently, a developer, start-up, or leading travel brand can join the platform, using either self-service APIs or enterprise APIs. This way, Amadeus maximizes the value of shelved intellectual property, welcomes start-ups, and manages informal collaboration.

4.1.2. Digital transformation of the business model

Traditionally, Amadeus’ B2B BM provided customized products to client specifications at premium prices. The entire BM of Amadeus was transaction-based, driven by as many transactions as possible through the infrastructure. The more markets were included, the more travel agencies would be willing to connect to the ecosystem and the more transactions would be made: a classic two-sided network effect model.

The digital enhancement and development of public API initiatives meant a restructuring of the architecture. Modern IT architecture enables companies to adapt product standardization, scale market dynamics, and, more importantly, construct an open platform via public APIs to accommodate a large pool of complementors. This approach supported the diversification of the existing business model/BM, creating a portfolio of BMs. The API business model portfolio of Amadeus encompasses two BMs: enterprise and self-service. Table 4 provides an overview of Amadeus’ BMs.

The first BM, “Enterprise APIs,” connects travel sellers (i.e., encompassing Amadeus’ and travel sellers’ solutions) and travel providers (i.e., any company in the travel industry, such as airlines, hotels, and car rental companies). The enterprise BM is a conventional B2B intended for major partners and customers. The pricing for enterprise customers and partners is transaction-based and is determined by commercial

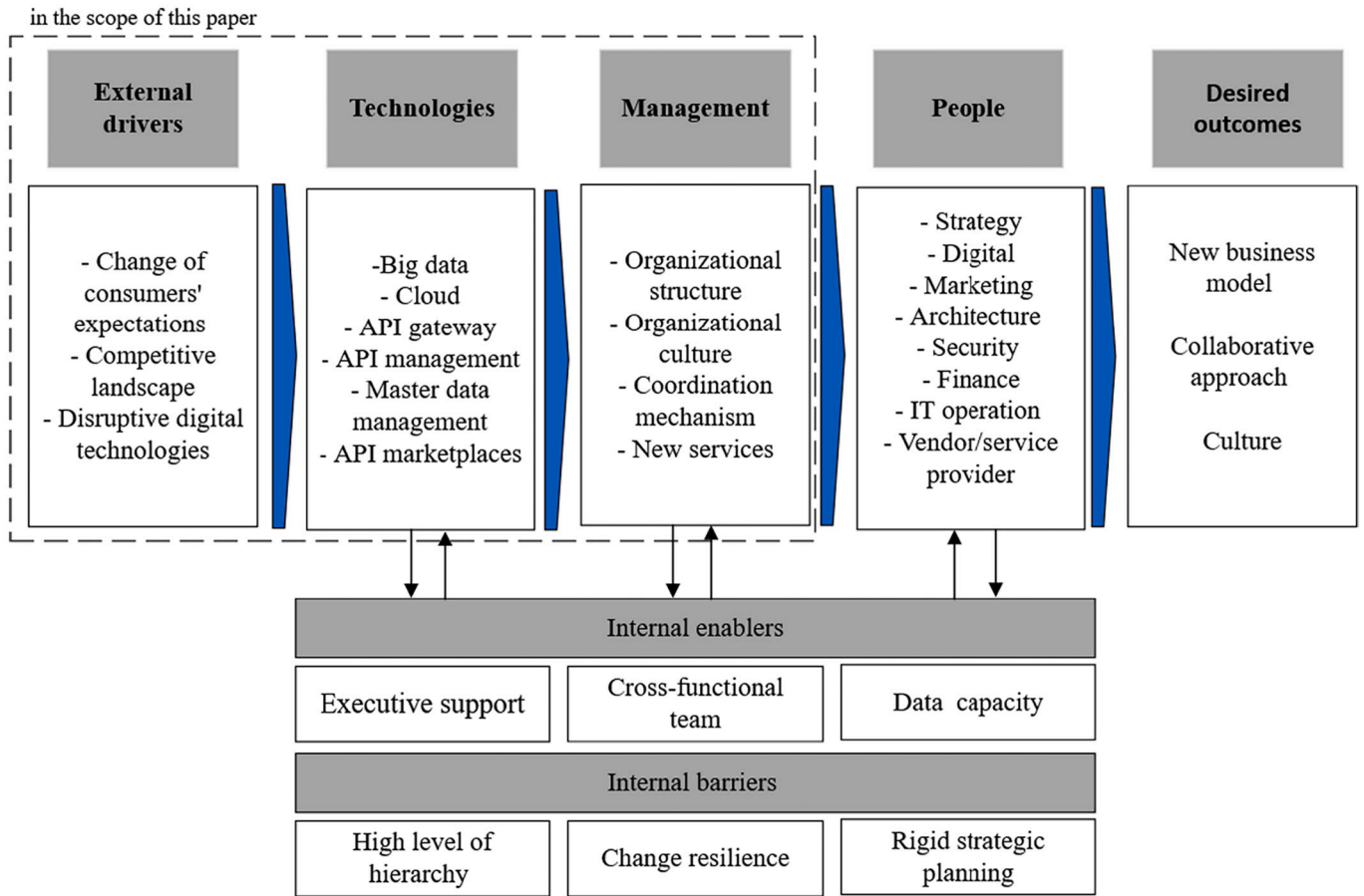


Fig. 3. Summary of Amadeus' activities in DT.

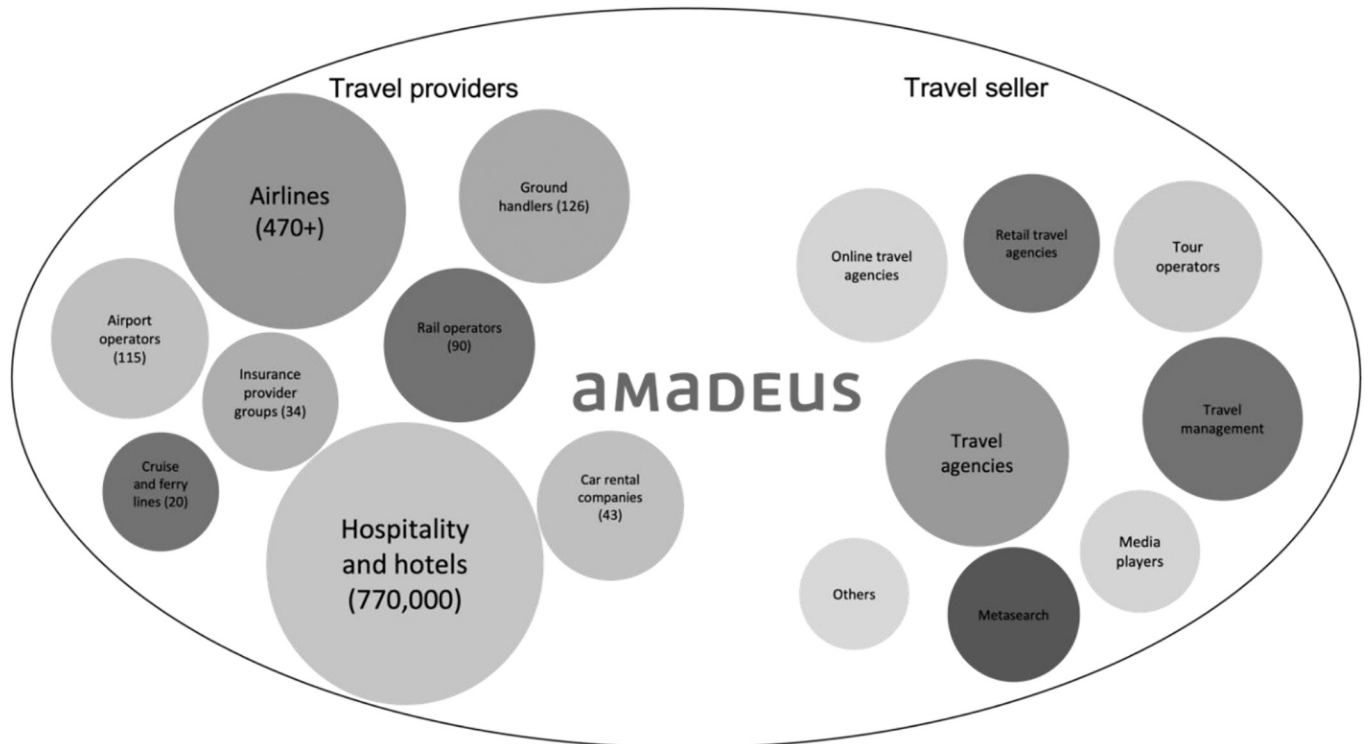


Fig. 4. High-level illustration of the Amadeus ecosystem (adapted from Amadeus, 2018).

Table 4
Two Amadeus API business models.

	Enterprise APIs Business Model	Self-service APIs Business Model
Customer sensing	Multi-sided BM: Links two customer groups: travel sellers and travel providers. Travel providers can list their offerings. Travel sellers search and book the best available offers and handle purchases.	Multi-sided BM: Links three customer groups: travel sellers, travel providers, and young and independent complementors. Third-party complementors get access to the richest information in the travel industry to introduce their solutions.
Customer interaction	Engagement: Amadeus provides access to a huge range of APIs: more than 41 APIs (16 exclusive) via SOAP/XML and REST/JSON API. Customers obtain in-depth content and value-added features. Support: <ul style="list-style-type: none">• 24/7 support and dedicated account manager• Implementation and product selection consultancy	Engagement: Amadeus provides access to about 25 APIs via REST/JSON API only with a limited threshold (500–10,000 free calls per API). Customers get quick access to production and immediate access to the test environment. Support: <ul style="list-style-type: none">• Immediate access to test environment• Self-service documentation• Developers' community
Value-chain linkage	Highly integrated system: Amadeus eliminates friction by linking together travel providers and sellers through an internet-based platform. Its high-performing servers enable Amadeus to deal with huge volumes of traffic. This way companies avoid the hassle of technology investment and complexity. All payments are handled by Amadeus via more than 300 payment methods.	Highly integrated system: Amadeus leverages its infrastructure and data to connect small companies and start-ups to innovate and launch their applications easily with a very fast time-to-market capability.
Monetization	Direct pricing: The service and its price are customized to each customer's requirements.	Dual monetization system: <ul style="list-style-type: none">• Pay-as-you go: 0.25–4 cents per call• Incentive fee for each successful booking (CPA)

negotiations. In the context of digital enhancement, it provided deep integration of strategic partners, such as TravelClick, to bring a range of robust products to the traditional transaction-based BM (i.e., enterprise BM) and access the strategically important midchain and independent market. TravelClick's Demand 360 program expanded Amadeus' hospitality sector by providing access to 25,000 customers across 176 countries.

The second BM, "Self-service APIs," is entirely the outcome of digital enhancement. It connects three different groups: 1) travel sellers, 2) travel providers, and 3) young and independent complementors (i.e., anyone interested in the travel sector with novel ideas). The self-service side is a new framework for connecting to absolutely anybody quickly and openly. It is a hybrid platform enabling both a transactions-based model with the mastery of payment complexity in the background, which simultaneously provides an opportunity for new innovations through ready-to-use APIs and a convenient developer environment. The monetization strategy of self-service is based on freemium, transaction fees, and revenue sharing, depending on the API used.

In summary, modern IT architecture allowed Amadeus to extend its traditional BM to introduce a new open API-driven BM. In addition to entering a new market, Amadeus is now able to interact closely with new clients, partner strategically, co-create value, and expand its ecosystem into a more innovative and open one.

4.2. Reflections on the business value of public APIs at Amadeus

Amadeus launched the Amadeus for Developers platform, knowing that the return on investment (ROI) would be a long-term goal. Hence, the overall company strategy has been to 1) manage competition and informal collaboration, 2) integrate an open API-driven BM to generate indirect revenue streams along with indispensable non-monetary benefits, 3) establish relationships with small companies and start-ups, and 4) create a synergic relationship between currently employed BMs to increase the attractiveness of the core product. These strategies have resulted in the formation of higher value generated by partners and API consumers on the platform.

Based on the themes that emerged from the content analysis, we identified six business values generated by exposing digital assets through the open API-driven BM: 1) commercialization, 2) ecosystem, 3) big data, 4) market and marketplace, 5) entrepreneurship, and 6) R&D. Each category is discussed in more detail below.

1. **Commercialization:** The business strategy is one of the primary motivators for launching public API initiatives. Amadeus has discovered two ways to gain direct revenue from public APIs. First, by providing close to free access to hotel and flight booking APIs. When a booking is made (the API is "consumed"), an incentive fee (up to 50% of the brand's revenue, as well as \$10 for each sale) is paid to the online travel agency for the successful booking, and the cost will be charged to the travel provider. Second, API consumers acquire an allowance of free calls. As this capacity reaches the threshold, a transaction fee based on the freemium model is charged for each API call, currently between 0.0025 and 0.04 cents (Amadeus, 2022).

In addition to direct revenue streams, when the need or business of self-service consumers ramps up, consumers usually migrate to the enterprise side to obtain a higher level of resource access and access an extensive catalog of APIs (Amadeus, 2022).

2. **Ecosystem:** One of the essential pillars of digital platforms is the emergence of ecosystems. Third-party complementors form an innovation system that stimulates the flow of internal and external knowledge, partnerships, and business opportunities. The self-service platform accelerates the onboarding process and encourages collaboration. It allows complementors to access APIs with little or no contractual arrangement. In comparison, a similar process on the enterprise platform is more complicated and time-consuming (each request must be handled manually, one at a time). In particular, the nature of self-service and fast-tracking enabled Smartvel, an SME based in Spain, to provide an easy-to-integrate solution for any travel provider interested in offering tours, activities, and services at the destination: up-to-date events (e.g., music, sports, cultural), travel guides (e.g., monuments, restaurants), and content promotion (e.g., tours, hotels, transfers).

Simultaneously, the open API-driven BM has created a virtuous circle between the owner of the platform and different players in the travel industry. The increasing number of complementors and APIs has inspired travel providers and sellers to join this compelling ecosystem, therefore the API platform is continuously expanding. Over the past two years, Amadeus has signed agreements with several airlines, such as Air India, Jeju Airlines, Lufthansa, Air France-KLM, and Finnair.

3. **Big data:** Amadeus has one of the biggest and broadest datasets in the travel industry, enabling the Amadeus service portfolio to cover a traveler's entire travel life cycle. This 360-degree view of the customer's journey is intended to create a single customer order record that holds all the data elements required to fulfill a booking (i.e., customer data, order items, payment and billing information, fulfillment data, and status). In addition, Amadeus provides technology at all stages throughout the traveler's journey. For instance, Amadeus Airport IT encompasses more than 20 solutions and covers all activities in the infrastructure, terminal, ramp, and movement

areas at the airport. Moreover, the company has invested heavily in open banking and acquired shares of Kontomatik in 2020. Kontomatik operates in 11 markets and provides access to data from over 130 banks both inside and outside Europe. API Kontomatik data are utilized for customer identification, detailed credit risk assessments, and precise customer segmentation. Thus, each step of the customer journey is continuously connected and captured by “micro-moments.” The interactions between travel agencies, travel providers, facilitators, and their customers (either online or offline or before, during, and after the trip) are logged.

4. **Market and marketplace:** Amadeus has reached a position in the market where it can gain insights into market segments and the characteristics of the demands. Such information leads to the development or revision of conjectures regarding the commercialization value of products. With this accumulated information, Amadeus not only has a profound knowledge of potential markets, but they can discover whether a product or a service has the potential for revenue generation. One indication of commercial viability and potential demand is the market demand for similar commercial products. The number of products in the market indicates that the solution has adequate value to compensate for the costs of exploitation. In addition, the existence of multiple products in the market suggests the feasibility of specific novel resource combinations, as well as reducing the information asymmetries between entrepreneurs and outsiders regarding resource acquisition and outsourcing.

The initiatives developed by third-party users are not owned by Amadeus, but Amadeus holds the core element in these solutions, helping the firm to achieve a lock-in position and sustain a substantial market position in the travel industry. Moreover, the open API-driven BM creates a synergic relationship between BMs and increases the attractiveness of the core product. This positive network effect in the API ecosystem helps Amadeus to further dominate the entire travel industry marketplace. As an example, Amadeus and Expedia Group are teaming up—bringing together Expedia, Egencia, Travelocity, Orbitz, [CarRentals.com](https://www.carrentals.com), and CheapTickets—to expand access to mobility content.

5. **Entrepreneurship:** “Amadeus for Developers” is part of a three-pronged external approach to foster innovation, encompassing a venture fund investing in start-ups and a strategic partnership program. Exposing public APIs helps in the form of gaining insights into market trends and vibrancy. Such perceptions of the market enable the recognition of opportunities to commercialize solutions driven by agents. User agents of public APIs carry prominent information on specific businesses, such as technology, performance, limitations, and commercial viability. API providers can monitor API usage to analyze and understand the consumption of their API products regarding the existence of a market and to what extent the product is used (frequency of use). Data obtained from user agents allow information-based, dynamic recognition and decision-making to commercialize opportunities. The open API-driven BM connects the company to start-ups in testing, improving, and promoting their solutions. In accordance with the Amadeus privacy policy, the company identifies business ideas that are aligned with its objectives and the needs of the ecosystem, leading to new value propositions or acquisitions (Amadeus, 2020a; Amadeus, 2020b).
6. **R&D:** Public APIs stimulate R&D within and beyond the organization. With the development of API ecosystems from various domains, Amadeus has accelerated its R&D process without experimenting alone. Third-party developers can build new solutions on top of Amadeus APIs, helping internal R&D to distinguish good ideas and perform external prototyping without an upfront investment. This outside-in flow of knowledge reduces the risks and costs as some experiments are handled externally for internal exploration (Amadeus, 2020a; Amadeus, 2020b).

Moreover, public APIs pave the way for ongoing research and development. Amadeus is continuously exploring new ways to

repackage its API products. For instance, the company integrated Jetstream’s hospitality solution to remove pain points for hoteliers and save considerable amounts of time and staff resources. Several API-driven technologies are under development by Amadeus. The company utilizes the “micro-moments” information and content provided by different ID providers to create a biometric integrator solution. Several airports have already implemented and/or are piloting biometric solutions to verify the identity of travelers digitally for boarding international flights and immigration processing.

Fig. 5 summarizes the value creation mechanisms through an open API-driven BM. The diagram shows why companies compete in the digital domain of APIs in different ways and what their potential gains are. On the left side of the diagram, the main strategic choice of a firm is to invest in and maintain an open API-driven BM. The arrows connect the causes with consequences (i.e., business values), and the double arrow connotes positive feedback loops.

Elements inside the business value box (right side) are business values, which accumulate over time and change slowly in response to the feedback loop. The deployment of public API initiatives extends the core BM and forms a new open API-driven BM. This new BM leads to the commercialization of existing API initiatives to the new markets of small companies and start-ups. Additionally, the mechanism of market diversification increases adaptation within both BMs. The growing number of public API consumers increases the incentive for established firms to join the enterprise platform, hence exposing their own APIs. Concurrently, increased adaptation multiplies the number of API consumers and providers in both BMs, which stimulates ecosystem growth. This is not only associated with company growth, but it also provides greater access to data that, more importantly, can be utilized to create customer profiling and gain market insights. In turn, this enables platform owners to monitor market dynamics and adopt vertical diversification, leading to entrepreneurship by acquiring or merging with innovative companies.

All of the information gained from big data and ecosystem expansion, either through onboarding complementors or entrepreneurship, is leading the firm to establish a core marketplace. Since the platform owner has substantial information about the ecosystem players, such information can be utilized to enhance customization, ultimately creating significant lock-in effects. In addition, big data, entrepreneurship, and ecosystems generate exceptional opportunities to access novel solutions, which in return feeds the platform.

5. Discussion

Prior research on DT has argued that DT is a tactical and strategic effort to introduce new ways to capture value (Horlach, Drews, Schirmer, & Boehmann, 2017). We would similarly argue that DT allows firms to productize and repackage API initiatives as tactical and strategic medians to diversify offerings and launch new open BMs. A company’s DT may often require a similar multisided structure, which can be enabled via digital, internet-based technologies. This approach entails the possible emergence of a positive network effect to expand the ecosystem. Both closed and open BMs link customer groups together to create and capture value by enhancing the offering (Tece & Linden, 2017). Nonetheless, their essential elements differ insofar as a closed BM is characterized by established firms using premium pricing. An open BM helps by reinforcing its bottom line and creating important synergies, as well as cross-selling across BMs in the portfolio. At the same time, an open BM (Chesbrough, 2007) focuses on increasing consumption within business and product categories.

In terms of non-monetary benefits, an open BM can create benefits from the greatest number of novel solutions while providing insights into a market dynamic that leads to benefits of the marketplace, R&D, and entrepreneurship. In comparison, closed BMs may focus on providing access to a more extensive range of products/services and

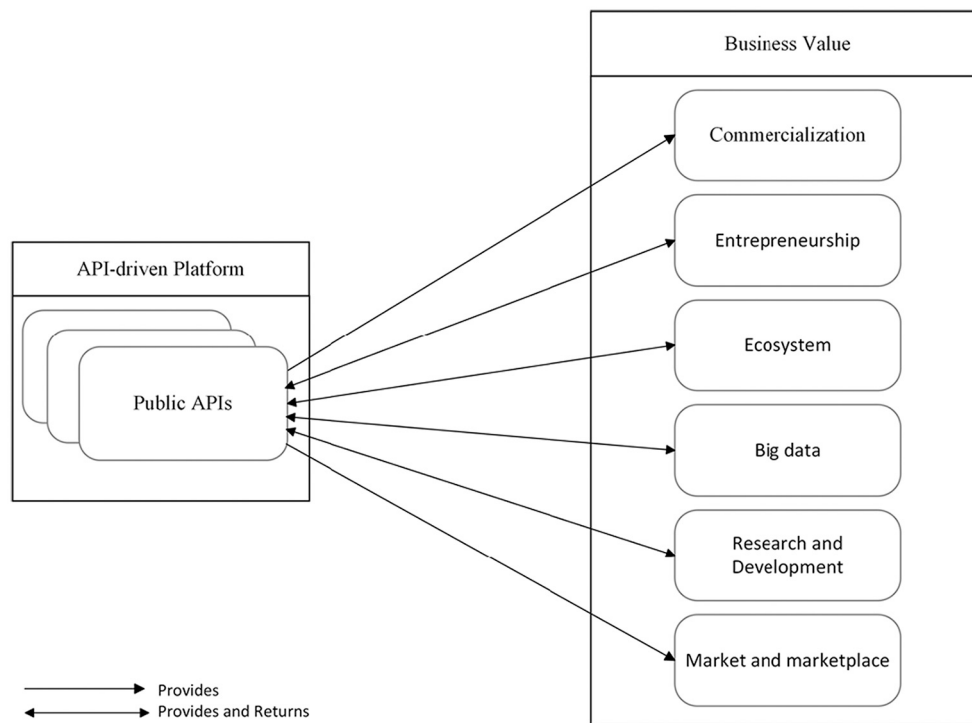


Fig. 5. Value creation mechanisms in an open API-driven business model.

creating network effects on the ecosystem, commercialization, and big data. However, it can be argued that big data retrieved from both BMs is the cause of the majority of business values (Sorescu, 2017).

Although it is clear what the advantages of an open API-driven BM are, some points still merit reflection. For instance, it is not clear which BMs are eligible to become an open platform ecosystem. Although some BMs might generate higher value in open systems, we recognize that an open role is the outcome of the firm's strategic decision-making process. In our case study, this led to purposefully using one system as a catalyst to develop the others in the portfolio and to gain non-monetary values.

6. Conclusion

In the current paper, we examined how an incumbent firm in a traditional industry implemented DT and digital assets to introduce a new BM for ongoing strategic renewal. We elaborated on the notion of the firm's extended digital resources as a device to create and capture opportunities. Our findings highlighted and justified the value of repackaging digital assets to cultivate an open ecosystem that remains relevant in the market and harvests different business values.

6.1. Research contributions and insights for practice

Despite recent developments and research on the subject of DT, the impact of digital platforms and public APIs remains a pivotal question, both in academia and business. The present paper makes three contributions. First, we document a success story of value generation through employing public APIs in the context of the platform business. Second, we contribute to the literature on API-driven BMs by demonstrating the implication of APIs as a strategic tool of value co-creation and, thus, for sustaining a competitive advantage in the six categories of entrepreneurship, commercialization, R&D, big data, ecosystem, and market and marketplace. Third, we contribute to the growing discussion on business model diversification by presenting a case example in the travel industry of running multiple business models in digital domains.

Our findings suggest four practical recommendations. Based on our

knowledge, nearly all medium and large companies use APIs to share resources and functionalities, either internally or among partners. Our results indicate that the boundary resource of APIs has surpassed its original purpose as a "technical asset" and has become a major force in renewing business strategies. We recommend that, to diversify their offerings, companies consider public APIs as a form of BM extension. Second, young companies often bring novel solutions. Exposing public APIs allows firms to identify new entrances and gain prominent information on the market dynamic. This was previously only possible through events such as competitions and hackathons. Third, APIs allow firms to attract and connect with more partners and ecosystems. Firms are usually reluctant to offer public APIs. Aligning the value proposition with intended value generation can help companies in the deciding which API to expose to expand their business vertically and horizontally. Finally, API integration accounts for more than half of all B2B collaboration (Geene, Garrett, Lane, Mauny, & Boyd, 2018), and it is expected that more prospective partners will adopt lightweight APIs. Hence, we encourage small companies to seize such opportunities and reflect on their level of contribution and participation in the API ecosystem.

6.2. Limitations and future research agenda

Like any research, the present study has limitations. The credibility of the study was ensured by familiarizing the researchers with the research data and holding an informal discussion with a company representative. Data triangulation was kept in mind when reading the material, and contradictory findings were discussed among the researchers. A single case study has inherent limitations in its generalizability; however, a detailed description of the qualitative research method, data gathering, and processing was considered to improve the transferability of the findings. Dependability was addressed by presenting in-depth information about the gathered data and the analysis process. In many respects, Amadeus, as a unique case company, has provided rich insights into the phenomenon of API-driven BMs. The confirmability of the study refers to the degree of neutrality that the study has. Naturally, a single case study is a drawback in this respect;

nonetheless, as Siggelkow's (2007) "talking pig" example showed, case selection sometimes justifies the fact that single case studies can provide important insights.

We believe that research has only partially revealed the implications and opportunities provided by API-driven BMs. Our study has highlighted that IS research rooted in a deeper understanding of digital technologies' roles and functions has much to contribute to the research on digital BMs and platform strategies. As technologies evolve and companies embrace innovative solutions for strategic reasons, more research is needed to explore the competitive dynamics of emerging digital technologies in strategic management research.

Finally, we outline six avenues for future research. First, multiple studies on the subject may provide a holistic view of the complexity of the values derived from API-driven BMs. Second, because of the nature of the competitive intelligence of APIs, we faced a significant challenge in investigating open APIs (i.e., private and public APIs). A new research method that enables the investigation of both private and public APIs together would uncover further business values. Third, the deployment of API initiatives as an additional channel diversifies firms' BMs and increases the adaptation of portfolio models. Thus, further research is needed to examine the positive and negative network effects of the new BM within a portfolio. Fourth, a study on the situations when an open API-driven BM should be deployed to avoid cannibalization and enhance the core BM would provide a refreshing argument in IS research. Fifth, we believe that interactions with the customer will most certainly represent a crucial component of company success; thus, further research is required to make the demand-side perspective a key standpoint for nurturing value creation and capture. Finally, digital platforms have the potential to create monopolies and dominate an entire market; therefore, the ethics regarding the development of digital platforms merits further study.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.digbus.2023.100055>.

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