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Business Model Analysis of Smart City Logistics Solutions Using the Business Model Canvas: The Case of an On-Demand Warehousing E-Marketplace

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Abstract: The rapid rise of e-commerce and advances in the technological sector have enabled the emergence of modern business models on e-marketplaces. Digital and on-demand e-marketplaces have become increasingly popular, responding to the trend of the sharing economy in various business sectors, but there is little guidance on how to develop the respective business models in order to ensure the long-term sustainability of such companies. The present paper is based upon the development and operation of an innovative on-demand warehousing e-marketplace in Greece as a one stop-shop for on-demand warehousing services. The purpose of this paper is to identify the necessary components for developing a successful innovative business model for a viable and effective on-demand warehousing platform. The identification of the value proposition of the proposed e-marketplace, the necessary business infrastructure and the customer interface are described, analyzed and adapted to the Greek Market. Furthermore, this paper also describes the cost structure and the revenue streams of the proposed on-demand warehousing e-marketplace.

Keywords: business model canvas; e-marketplace; innovation; on-demand warehousing; sustainable business models



Citation: Parodos, L.; Tsolakis, O.; Tsoukos, G.; Xenou, E.; Ayfantopoulou, G. Business Model Analysis of Smart City Logistics Solutions Using the Business Model Canvas: The Case of an On-Demand Warehousing E-Marketplace. *Future Transp.* **2022**, *2*, 467–481. <https://doi.org/10.3390/futuretransp2020026>

Academic Editor: Laura Eboli

Received: 9 March 2022

Accepted: 17 May 2022

Published: 19 May 2022

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1. Introduction

Rapid improvements in the technology sector have enabled the emergence of innovative business models based on digital platforms [1]. Digital platforms extensively transform business models and inter-company and customer relationships in Industry 4.0 contexts [2]. In addition, [3] identified three predominant types of digital platform orientation regarding the main business models and platform motivations, while [4] analyzed and compared innovative business models from multiple case studies, showing key differences and similarities. Popular e-marketplaces such as AirBnB or Uber can now connect previously unmatched demand and supply side users through novel forms of value creation, delivery and capture. Moreover, the continuous increase in e-commerce, in combination with urbanization in bigger cities, has created a need to constantly evolve companies' business models in order to find smart and viable solutions to survive in a rapidly changing and highly competitive business environment. The trend of e-commerce over recent years has also contributed to changing the traditional way of doing business and has allowed a remarkable rise in the sharing economy, which is subsequently expressed through on-demand digital platforms. Moreover, the ever-increasing importance of business responsiveness to adapt to customer requirements has created the need for on-demand services in several business sectors, including logistics and warehousing. Furthermore, the rising need for finding flexible storage services, as well as developing synergies across the supply-chain through an easy-to-use online platform, has led warehousing companies to develop on-demand services to better satisfy their customers' requirements. Regarding

the Greek Market, little is known about the physical retail warehouse market. A lack of visibility regarding the available warehousing spaces across the country and their technical and quality characteristics is noticed, thus making the process of finding suitable storage space for the logistics actors very time consuming and costly, preventing the design and development of on-demand warehousing services. In addition, the sharing economy and on-demand platforms have just started to gain interest in most business sectors, including warehousing. To date, however, there is a lack of understanding about the distinctive business models that could be applied in such on-demand digital platforms. The purpose of this paper is to present a viable business model for the first on-demand warehousing platform in Greece, the Virtual Freight Center (VFC), by using the business model canvas approach tailored to digital platforms. The next chapter presents an extended literature review about city logistics and the rise of e-commerce, in addition to the emergence of the sharing economy and the respective business models used so far. Additional insights including the impact of the COVID-19 pandemic on the sharing economy, and an analysis of consumer behavior in optimizing last mile deliveries is also highlighted. The following chapter focuses on the case of VFC, describing the on-demand warehousing platform and its business model developed using the business model canvas as the most appropriate tool.

Summarizing the information in the present paper, the proposed business model of the company is described by using the business model canvas tailored to digital platforms as the most appropriate strategic tool. Through this approach, the visualization of the necessary elements of the company's strategic management in order to develop a successful business plan for an on-demand warehousing e-marketplace is achieved. The results provide guidance to innovative companies that want to embrace principles of the on-demand economy.

2. Materials and Methods

The present research consists of four (4) distinctive methodological steps. At first, an extended literature review for mapping the existing logistics and warehousing facilities was conducted, mainly focused on the industrial centers of Thriasio and Sindos. After the completion of the literature review, a dedicated focus group was organized with the participation of fifteen (15) logistics experts from various logistics and supply chain actors in order to discuss the current warehousing conditions in the Greek market and their willingness to adopt on-demand logistics solutions in their daily operations. The logistics experts were selected on the basis that they could potentially be platform users from both sides of the market, i.e., from the demand as well as the supply side.

In order to validate and improve the results of the focus group, the next step was a questionnaire survey targeted at Greek logistics and supply chain actors. In total, 90 logisticians from 69 dominating companies participated in the survey. The survey was conducted in a targeted logistics and supply chain conference in order to collect representative data from the participating companies. Again, the conference for the survey was selected due to the large number of companies that could use the platform, either by offering storage space (supply side) or by requesting warehousing facilities (demand side) for short-term or long-term warehousing. The final step of the present methodology was a comprehensive analysis and mapping of the Greek warehousing market.

3. Results

3.1. Research Background

3.1.1. City Logistics and Rise of E-Commerce

Globalization is a term that characterizes our era. According to the UN, until 2050, approximately the 70% of world population is estimated to live in urban areas [5]. The rise of the population in metropolitan areas leads to the expansion of urban areas, enhancing cities' complexity. This trend pushes logistics operators to redesign the framework under which they operate and find more efficient and sustainable ways of providing logistics services in urban areas.

As mentioned in the literature, the purpose of city logistics is the identification of the proper process for transporting goods within a city [6]. Given the tendency for overcrowded urban areas, city logistics and their efficiency play a key role in the lives of more and more people [7]. Even though it isn't perceived at first, city logistics affects cities prosperity [8] in terms of economic advancement, social cohesion and environmental sustainability [9].

In addition to the increased complexity in city networks, technological advancements such as e-commerce has dramatically altered the retail sector in the past two decades. [10]. From 2014 until 2019, the e-commerce sales ratio has been tripled globally, while, until 2023, e-commerce is estimated to represent 20% of the global retail share. This evolution is based on multiple factors, among which the large diffusion of personal computing devices and technological advancements are the major ones [10]. Finally, it has to be mentioned that COVID-19 acts as driver for the rapid development of the e-commerce, increasing electronic transactions and seamless payments and stressing supply chains [11,12]. In the EU-27, retail sales via mail order houses or the Internet in April 2020 increased by 30% compared to April 2019, while total retail sales diminished by 17.9% [11].

The sharp rise in e-commerce has created many opportunities for businesses, removing spatial constraints, creating visibility to a wider consuming audience. However, new challenges come in the foreground. The most common e-commerce business model is B2C (Business-to-Consumers). The ever-growing demand for online orders in combination with consumers' small size orders creates a complex framework within which logistics operators have to cope. The major operational pressures on logistics operators are commonly related to providing reduced lead times in restricted time window deliveries and home delivery failures due to the customer's absence [13] while at the same time keeping prices at the lowest level [14].

As mentioned previously, the major impact of e-commerce in city logistics systems refers to the cost related to freight distribution systems as well as their optimization [9]. In e-commerce, the vast majority of orders consist of small orders from multiple customers, with the necessity that they be delivered in a restricted time window. Logistics providers have to spend a huge amount of resources, utilize the available infrastructures and invest in planning in order to cope with these challenges. In order to retain low-level costs and achieve greater revenues, new distributing methods have come to the fore. Some online retailers who own physical stores, using them as consolidation and distribution centers in order to gain proximity to the market, minimize delivering costs and improve their responsiveness. Additionally, the click & collect method is also utilized by those retailers in order to avoid loss-making in last-mile deliveries as well as to gain profit from in-store purchases [15]. In the same philosophy, on-line retailers use pick-up points such as locker banks to reduce operational costs (home delivery failures, flexible time window), reduce environmental impact (reduced fuel consumption and emissions) and be closer to the end-users [13]. Finally, the CIVITAS Forum Network, in their effort to support and promote sustainability in urban freight logistics, provide an extended list of good practices already implemented in cities around EU. The list includes guidance for the implementation of market-based measures, enhancing stakeholders' engagement, policy regulations, land use and infrastructure utilization, as well as introducing new technologies and enhancing awareness of eco-logistics [16].

3.1.2. Sharing Economy and the Rise of On-Demand Digital Platforms

The rapid rise of e-commerce led also to a new trend, as societal interests have shifted from the traditional ownership philosophy towards sharing goods or services by the use of digital platforms. In this direction a great effort has been made, towards the identification of the sharing economy philosophy. However, there is still a lot of confusion in the literature on the exact definition of the sharing economy, with related terms such as on-demand economy, peer-to-peer economy [17] and gig economy [18] adding to this confusion.

Given the social shift to the sharing economy, the success recorded on sharing assets on-demand, such as homes (AirBnB) or cars (Zipcar), through digital platforms did not go unnoticed. These platforms are essentially marketplaces aiming to meet available supply with the requested demand. Additionally, the rising need to provide effective services to customers has led logistics providers to rethink three-key segments: logistics transportation, on-demand warehousing and fulfilment.

To achieve higher levels of responsiveness, the need for businesses to retain their inventory as close to end-customers as possible has been identified. However, the process of finding flexible on-demand storage spaces is quite difficult due to low visibility, a lack of high standard infrastructures or high long-term commissions. One of the advantages of the sharing economy is the ability for enterprises to create on-demand synergies and share cost-intensive assets such as warehouses, vehicles, information flows and workforce through the use of digital platforms. A turn to on-demand warehousing and transport capacities has been noticed recently as an alternative to traditional solutions, in order to reduce fixed operating costs, achieve better assets utilization rates, be more responsive and enhance supply chain resilience.

The sharing economy as a new economic trend has faced fundamental changes due to the COVID-19 global pandemic. The sharing economy was growing very fast prior to the pandemic outbreak. According to [19], the value of the sharing economy would have been \$335 billion in 2025, and this estimation was close to becoming a reality. The impact of COVID-19 on some sectors of the sharing economy was so severe that some experts were afraid that the pandemic could end the era of the sharing economy [20]. As most of the population was in lockdowns for months, and the post-lockdown period was characterized by distancing rules, the demand for specific sharing services significantly declined [21]. Sharing services related to hospitality and transportation faced massive challenges in order to adapt to that new reality. Companies such as AirBnB [22], Uber, Lyft [23] and many others suddenly had to face a massive decrease in their revenues.

However, the COVID-19 pandemic did not have a negative impact on all sharing economy services. On the contrary, it created some significant opportunities to be exploited. The use of online shopping and food delivery services [24] exponentially increased, thus resulting in the rejection of the statement that the pandemic will end the sharing economy, as the impacts of the COVID-19 related lockdowns were not the same for all sectors of the sharing economy.

It can be seen that the sharing economy is not a homogenous market [25] despite its widely acknowledged benefits, thus causing difficulties to companies in finding the most suitable business model, while there is still lack of guidance on how to adapt to respective platform business models. It is therefore extremely important to examine and identify the framework of business models and identify the specific features that will make them viable and add value to the companies. Regardless of the way in which a business currently operates, either through a sharing economy platform or in a traditional way, it is essential to understand the operational philosophy of sharing economy platforms. In this line, an effort has been made in the framework of this paper to identify the specific characteristic business models of the sharing economy that platforms need to take into consideration during the development process.

3.1.3. Sharing Economy Business Models

Several approaches have been made in the literature to explore the characteristics of the sharing economy business model. First of all, for reasons of common sense we need to provide a definition of a business model. A compact definition is given by Teece, who indicates that each business model has to provide a clear definition to the respective enterprise regarding value creation, delivery and capture mechanisms employed [26].

Following this definition as base ground, Täuscher classifies business models for sharing economy platforms into six categories. In addition, the strongest elements regarding value creation, delivery and capture mechanisms are identified. Regarding value creation,

the type of platform is the strongest differentiation element that needs to be taken into consideration, while in the value capture dimension, the revenue model is the corresponding strongest element. Finally, regarding the value delivery dimension, three elements were identified as the strongest differentiation elements and refer to the platform participants: the value proposition, the transaction type and the good [1].

Popular marketplaces such as Uber or AirBnB have changed forever the traditional business models used by companies to create value and sustain competitive advantages. The rapid development of these digital platforms has enabled the emergence of innovative business models in order to provide new value propositions and novel revenue models. According to [1], there are three main business model elements, and their potential specifications seem to be of high relevance in marketplaces. The proper selection of these elements and their specifications is of vital importance for every business model and could play a very important role in the success or otherwise of the marketplace. This paper aims to identify a viable business model for an on-demand warehousing marketplace by following specific dimensions and attributes that will lead to the development of the business model canvas for the first such platform in Greece.

3.1.4. The Case of the First Virtual Freight Center (VFC)

The global financial crisis in 2009 enhanced the ideological impetus of using technological advances in building an economy that was more social, sustainable and resilient. However, not all sectors had the ability to engage in new innovative business practices and models. Real estate is one of the sectors affected the most, especially in the Greek market. After a decade of economic recession and the consequent insecurity prevailed, investments on new and high standards warehouse infrastructures were frozen.

Given the increased need for on-demand warehousing and the lack of visibility in the market, e-marketplaces have developed added value services, apart from operating as platforms matching supply with demand. Through their use, companies leverage from flexible arrangements, such as a pay-as-you-go model, without committing to unnecessary long-term agreements, while warehouse providers can utilize their unutilized storage space and make extra profit.

It is well-known that over the last few years, e-marketplaces for on-demand warehousing have become increasingly popular around the world. Companies such as Flexe provide warehouse and fulfilment services through a network of more than 1000 warehouses all over USA. Similarly, a company called Ware2Go provides on-demand solutions through a nationwide network of certified warehouses enabling companies of all sizes to effectively compete and grow. These e-marketplaces are increasingly gaining attention, with many yet to be developed (Stockbooking, FlowSpace, Stowga, a.o.); however, in the Greek market, little attention has been paid.

In response to this, a research project under the name Warehouse Match & Optimize (WareM&O), co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, has developed a Virtual Freight Center (VFC).

The aim of the VFC is to create the first on-demand warehousing platform in Greece, providing a comprehensive observatory of warehouses, increasing visibility in the market and optimizing the utilization of the unused storage facilities through a single access point. The ecosystem of the e-marketplace will constitute industrial partners and LSPs. Through VFC, users will be enabled to participate in collaborative storage schemes, having detailed and real-time information regarding the available storage spaces as well as their specifications. Moreover, VFC will enhance the notion of short-term leasing, not excluding long-term leasing solutions when requested, and the introduction of flexible and transparent “pay-as-you-go” pricing policy will benefit both the supply and demand sides.

In order to ensure the successful implementation of the tool and achieve high penetration rates in the market, it was essential to engage key actors of the market in the development process in order to identify the maturity and adaptation levels of the on-

demand platform concept among Greek professionals. For this reason, a survey has been conducted, the scope of which was to identify current trends in the market and highlight the needs of the key actors. Finally, an important aspect of the survey was to identify the potential interest of Greek stakeholders in engaging with flexible warehouse models through the use of an innovative on-demand warehouse e-marketplace, as well as to identify future challenges.

The survey was conducted with the participation of 90 stakeholders coming from the Greek logistics industry from across the supply chain in October–November 2019. The results show that regarding storage infrastructures, the great majority of participants (63%) operate through their privately-owned warehouse and distribution system, while many of them (41%) use a hybrid model for their operations by assigning their distribution to 3PL logistics providers (Figure 1).

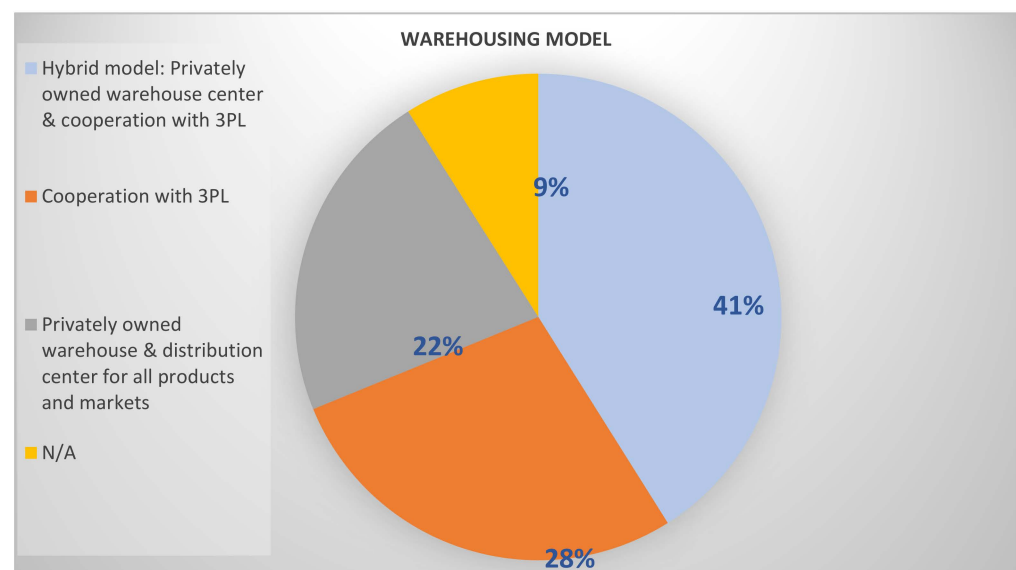


Figure 1. Capture of the existing warehousing models in the Greek market (source: Authors' survey).

Additionally, almost half of the participants (48%) express they are in need of short-time warehouse solutions. Moreover, half of the participants (50%) mention that they are in need of long-term warehousing solutions (Figure 2). Despite the fact that 44% of the participants are currently offering space and/or warehousing services, more than half of them mention that they face difficulties in finding appropriate storage facilities. These results highlight the necessity of providing flexible and low-cost warehouse solutions in the Greek market.

In order to better understand the factors setting barriers in their daily operations, participants were called so that they could provide their feedback. As the results indicate, the lack of visibility across the supply chain and the effective response to the increased demand are the major challenges to face (Figure 3). However, it is quite encouraging that the participants (79%), seem to understand the importance of investing towards the digital transformation of the supply chain and the utilization of innovative tools to optimize business processes.

Having a clear view of participants' warehousing operation models and their needs, it was essential to further explore their intention to use a VFC platform as well as their willingness to cooperate in a sharing warehouse capacity scheme either on the supply or the demand side. The results that were obtained are quite encouraging, as almost all participants (78%) shared a positive attitude towards the operation of such a tool.

However, a great majority of these does not seem to feel ready to adopt this tool. This lack of willingness is mainly due to the fact that participants fail to conceptualize the benefits and the exact impact of implementing VFC in their daily routine [27]. Summarizing

the survey's results, it is understood that the Greek market, although not mature yet, shares a positive attitude towards the development of new technological solutions that will enhance visibility within the supply chain and provide the opportunity to improve their operational procedures through engagement in new collaborative warehousing models.

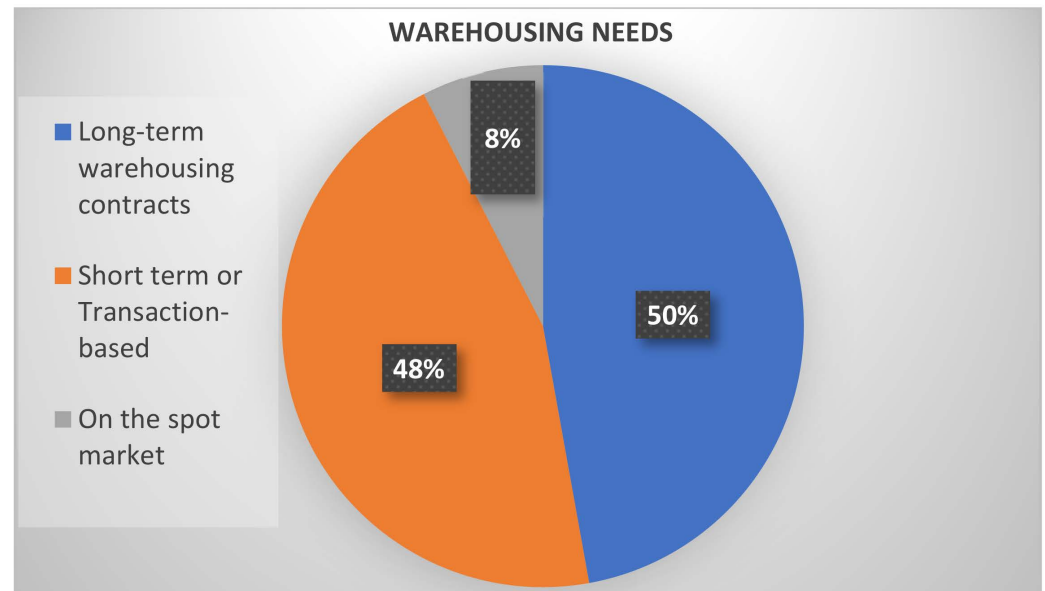


Figure 2. Warehousing needs in the Greek market (source: Authors' survey).

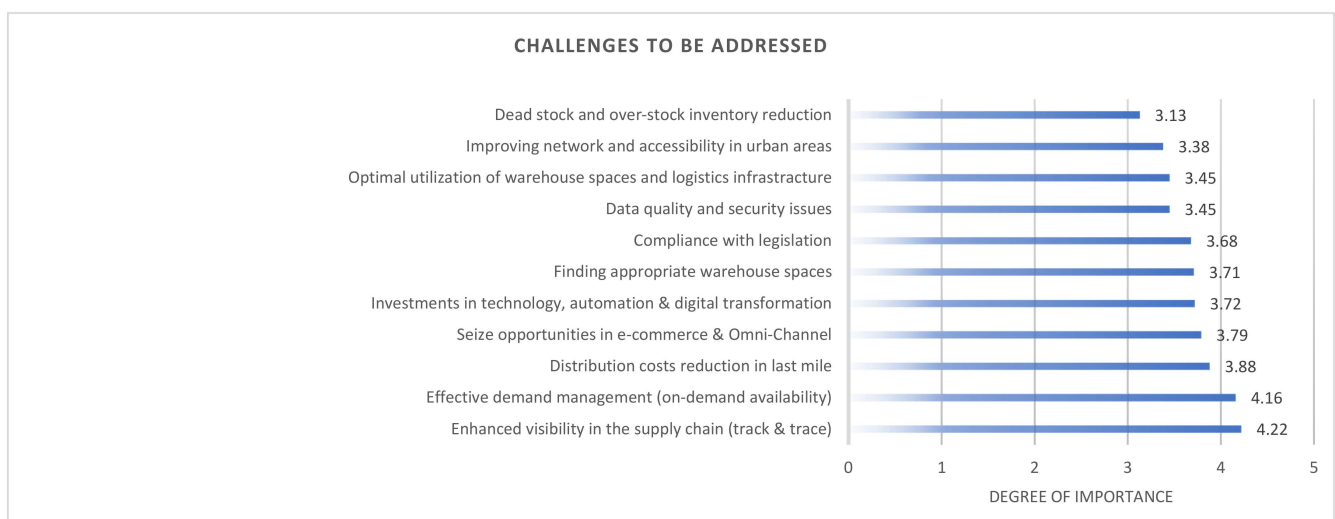


Figure 3. Current challenges in the Greek market (source: Authors' survey).

3.2. Viable Business Model for an On-Demand Warehousing Marketplace Business Model Strategy

The development of the first on-demand warehousing marketplace in Greece implies a road to the unknown when the time comes to develop a business model strategy in order to identify the significant attributes of the model and its respective specifications. Section 3.3 presents the business model of the VFC by using the Business Model Canvas approach.

In our business model, VFC is the platform through which supply and demand for warehousing spaces will be connected. The target of the VFC is to play an important role in warehousing sector by offering high quality services for matching supply and demand for appropriate warehousing places in Greece. In that way, VFC will create enhanced visibility and fairness in transactions, which will enhance the competitiveness and productivity of

the companies operating in Greece. The vision of VFC is to become the leader of on-demand warehousing first in the wider areas of Thessaloniki and Athens, then throughout Greece and in future throughout the Balkan region, being the reference point for the economical and efficient searching for and finding of professional storage spaces for all types of businesses.

In order to develop our business model, we first performed a thorough environmental and competition analysis in order to identify the current conditions in Greece and the business environment for the new innovative on-demand warehousing platform of VFC. The analysis revealed that the search for rented storage space by companies is carried out mainly through: (a) cooperation with 3PL companies that offer logistics and warehousing services, (b) direct research and communication with the available spaces by the interested companies, (c) cooperation with real-estate agencies and (d) international e-marketplaces that offer their services in Greece, although these have a limited penetration into the Greek market so far.

In relation with the above, the value proposition of the VFC is significantly different, offering diversified services that are not offered today in the Greek market. The description of these services is beyond the scope of this paper, but it indicates the holistic view of the VFC platform and the efforts to develop a sustainable business model based on an innovative on-demand platform.

Following the competition analysis, we next analyze the forces exerting pressure on the warehousing and logistics industry and the companies operating in it according to the Porter model of 5 forces.

1. Threat of new inputs: VFC will operate in a free market in which any competitor could enter, either a domestic or international. For this reason, VFC will follow an expansive pricing policy and a dynamic and extensive marketing plan in order to establish the brand name of VFC.
2. Customer bargaining power: Considering as customers those looking for storage places, those offering their excess capacities and those who will use VFC in order to enhance their visibility on the market, it is expected that each customer will represent a small share of the total market and therefore will not have great bargaining power. Exceptions may occur from large commercial or 3PL companies that could use VFC regularly for large spaces, as well as large warehouse owners that offer large available space for rent.
3. Bargaining power of suppliers: VFC offers its services through an online platform and is not a commercial company. From that perspective, VFC does not have suppliers in the traditional way. Its suppliers are the owners of storage spaces that have spaces for rent who are at the same time its customers, and therefore their possible bargaining power is described in the previous paragraph.
4. Threat of substitute services: Substitute services already exist in the form of real estate services as well as other online general real estate search platforms for rent or purchase. However, these solutions are considered insufficient to effectively meet the demand, while the VFC also aims to increase the size of the warehouse rental market. It is estimated that the complete package of services it will offer will allow it to capture a significant market share held by substitute services today.
5. Competition between existing companies: The analysis showed that there is not direct competition, since VFC will be the first on-demand platform specializing in finding warehousing spaces and relevant services. However, there is indirect competition from companies that provide similar services and companies that currently operate abroad. The indirect competition will be addressed by continuous investment in innovative services and the provision of high-quality and value-added services that will create and expand the current competitive advantage of the VFC.

In addition to the previous analysis, it was decided to conduct a SWOT analysis in order to identify and analyze the internal and external factors that affect the viability of VFC. The results of the SWOT analysis are highlighted in Table 1.

Table 1. SWOT analysis for VFC (source: Authors' survey).

Strengths		Weaknesses	
1.	Monitor all/significant part of the available storage space.	1.	Lack of direct contact with the customers of the platform, which is important for the establishment of the professional relationship & trust.
2.	Increasing the total available storage space.	2.	Coverage of a significant part of the offer is required for the proper operation of the platform algorithm.
3.	Increase the utilization rate of existing storage spaces.	3.	Inability to complete (temporarily) the financial transaction through the platform, thus weakening the role of the service.
4.	Ensuring fair value (fair price) based on the market trends in a given time.		
5.	Possibility of additional income for commercial companies that have a surplus of private storage space.		
6.	Facilitation of the entry into regional markets of companies that do not have local bases.		
7.	Transparency in transactions.		
Opportunities		Threats	
		1.	Reluctance to publish data by the companies targeted by the platform.
		2.	Competition between companies that could cooperate as they have/need spaces of similar specifications can make the operation of the platform difficult.
1.	Expected development of the warehousing sector in Athens & Thessaloniki due to the existing (Athens) and expected (Thessaloniki) development of their cargo ports.	3.	Possibility of dynamic entry from strong foreign companies operating in the same field when the viability of the project is proven.
2.	Lack of strong and organized competition as well as a similar specialized platform by a company that has knowledge of local conditions.	4.	Unstable demand cycles due to unforeseen situations such as e.g., the COVID-19 pandemic can cause significant fluctuations in VFC revenue and consequently in its viability.
		5.	Difficulty in choosing the appropriate pricing policy.

The SWOT analysis shows that the strengths of VFC, as well as the potential opportunities that it presents, may create the conditions to change the correlations in the Greek warehousing market (operating in a similar way to disruptive technologies) and can put VFC as leader of the new condition. On the other side, the weaknesses and most of the threats could be eliminated through:

- proper functioning, which will establish confidence and trust between the parties in the provision of sensitive data;
- continuous development, which will give the opportunity to sign dynamic contracts and complete the transaction through the VFC platform;
- a proper promotion plan that will lead to an increase in users.

3.3. Viability Analysis and Revenue Model

The next element in the development of the VFC business model was to determine a sustainable revenue model based on multiple factors that can highly influence the choice of the appropriate pricing policy of the VFC. Before the revenue model, an in-depth analysis of the total Greek market and the potential VFC penetration formulated a robust analysis in order to identify the appropriate pricing policy and the projected incomes and expenses for a sustainable feasibility study to rely on.

The extensive research and the relative VFC services showed that VFC aims to penetrate (a) to the existing overstock market of Logistics Service Providers (LSP) and (b) to the new market of outsourcing logistics services. The market analysis in Greece and the specific targets for VFC showed a remarkable market size [28]. An industry report by ICAP for 2018 showed that the market for LSPs is estimated to produce revenues of € 418.9 million, with significant growth prospects for the next five years. According to the same study, LSP revenues from warehousing services account for 59.5% of total revenues (€ 249.25 million), with 34.5% of these (€ 86.2 million) net for pallet storage services (excluding pallet import and export services or other services such as returns). From this amount (€ 86.99 million/25% of the total) comes the main target market of VFC in terms of the LSP market.

Based on the same research, it is worth mentioning that dry cargo storage services account for 75% of the total market revenue (€ 64.49 m), while refrigerated product storage services account for the remaining 25% (€ 21.5 m). In addition, with the current LSP market condition, a significant market share is expected to result from the strengthening of outsourcing in logistics. Currently, many companies do not have a logistics service provider, thus resulting in low logistics outsourcing (less than 40%) compared with the rest of Europe (more than 70%) [19]. Our estimation for the upcoming years is that outsourcing, especially for warehousing services, will significantly rise, thus revealing an important area for penetration for the VFC. Finalizing all the above, the total target market for the 1st year of operation of the VFC is estimated at € 90.29 m, as summarized in Table 2 below.

Table 2. Summary of VFC Target Market Size Estimations (in million €) (source: Authors' survey).

Market	Size	Explanation
3PL market @ 2018 (ICAP)	380.16 €	Market size 2018 according to ICAP sector study
Total 3PL market @ 2020 (est.)	418.90 €	Estimation + 10.2% for 2020, based on ELSTAT
Warehousing revenues	249.25 €	Estimation of share 59.5% of the total market for warehousing services
3PL storage market revenues (year 1)	+85.99 €	Estimation of share 34.5% of the total market of warehousing for storage services like VFC
New outsourcing market (year 1)	+4.30 €	Estimation of additional market from rise of outsourcing at storage services
Total target market	=90.29 €	The estimated total market of logistics services at the start of operation of the VFC platform in 2022

Based on the analyses and estimates of the VFC sustainability report, the overstock market in the existing LSP market and the new outsourcing market are expected to be VFC's most important sources of revenue. The percentages of overstock storage were estimated at 35%, 15% and 40% of the total dry, refrigerated and frozen cargo storage, respectively. The penetration in these markets is expected at the start of the operation (2022) to be around 2.5% for dry cargo, 0.5% for refrigerated and 3% for frozen cargo. with a prospect that by the end of 2027, the penetration in this target market could reach 4.2%, 1.1% and 5.9%, respectively, for the target market of LSPs.

For the new outsourcing market, it is estimated that VFC will have significantly greater penetration. After all, VFC aspires to be a catalyst for enhancing outsourcing, as it provides businesses with a tool that will allow them to have complete control over the cost and quality of their logistics activities even after outsourcing these activities. The penetration in these markets is expected at the start of the operation to be around 3.5% for dry cargo, 1.0% for refrigerated and 5.0% for frozen cargo; with a prospect until the end of 2027, the penetration in this market may reach 11.0%, 2.4% and 14.7%, respectively. Based on the analysis above, the revenue model is developed in order to ensure the viability of the VFC platform. To develop the revenue and expenditure calculation model considers the following assumptions:

The first assumption concerns the growth rate of the logistics market. This rate is calculated from the GDP growth rate and a logistics-specific multiplier, which considers that the logistics market increases 1.5 times faster than GDP growth [29]. This view considers international benchmarks and the fact that falling prices and offers on commodities ultimately lead to an increase in moving cargo even when consumption is stable. Another key assumption concerns inflation in both equipment supply prices and employee payroll. The first affects the operating costs of VFC (e.g., purchase of equipment), but it mainly affects the revenue, as it affects the cost of logistics services by users-sellers of the platform, on which the VFC commission is calculated.

Based on the above assumptions, VFC developed its pricing policy in order to ensure a viable revenue and expenditure model. The revenue model is developed in two areas. The first area is a 5% commission charge per transaction, which is allocated 2.5% to users-sellers and 2.5% to users-buyers. The second area is a 20€ monthly fee for using the platform regardless of the number of transactions. Finally, in order to give the necessary boost for a new platform, it was decided to provide a bonus of free months of subscription in the first two years. The commission on transactions used by VFC is a common revenue model for international on-demand services and especially for those that have the same object as VFC (Flexe, Stockbooking, Stowga). Utilizing the practices of the above companies, users are willing to pay a commission on the transaction to use the services offered by the platform to save valuable time but also to enjoy the preferential prices guaranteed by the fair pricing algorithm. For the monthly subscription revenue, it is necessary to estimate the number of users who will register in the VFC. There are two kinds of users in the VFC platform, the users-buyers and the users-sellers. It is estimated that the registered buyers will outnumber the sellers, thus providing a wealthy competition between the registered users. The revenue from the monthly subscriptions is not considered critical for the long-term viability of the VFC platform since the main revenue comes for the transaction fees.

On the other hand, it is necessary to calculate a robust expenditure model in order to cover at least the initial capital expenses in the beginning of the platform. The expenditure model considered the capital expenses (SQL server license, PCs, offices and decorations) and the operational expenses. The operational expenses of the VFC platform concern the following categories:

- Administrative expenses: salaries of executives and administrative staff;
- Direct labor costs: salaries of developers and other employees;
- Marketing expenses: expenses for the implementation of the commercialization and promotion plan;
- Office space rental costs;
- Outsourcing costs: costs for services outsourced by the VFC, such as lawyers and accountants;
- Other expenses: expenses for hosting the software, maintaining the backup in a cloud environment, the maintenance of the server and the consumables;
- Depreciation: Refers to the costs of depreciating equipment.

All the above expenses were considered, where inflation has also been considered on the basis of pre-determined annual rates. Based on the previous analysis for the calculation of the market penetration that VFC will succeed, the estimated income and the expenses, we come to the forecast of the results for the period of 6 years in Table 3.

In the first year, there is a negative EBT of € 216 thousand, which must be serviced with equity and borrowing. Respectively, the second year also shows significant losses, although they have decreased to below half of the first year. But again, these would mean that you have to spend for these processes. For the rest, from the third year onwards, the platform's revenue is already very significant, allowing the immediate reversal of the EBIT from −37.5% in 2023 to +24% in 2024. Maintaining a conservative market share in the target market close to 5%, VFC rapidly increases its revenues as the market grows and expands with the parallel strengthening of outsourcing.

Table 3. Profit & loss statement forecast (source: Authors' survey).

(€ '000)	2022	2023	2024	2025	2026	2027
	Total Revenues					
Sellers commission revenues	0.0	1.2	2.6	4.3	6.7	7.0
Buyers commission revenues	0.0	13.4	43.2	67.9	96.0	100.6
Transactions fees	88.1	221.4	377.4	543.2	698.1	785.4
	88.1	236.1	423.2	615.5	800.8	892.9
Operating costs						
Direct Labour	68.3	86.6	88.3	90.1	92.3	94.6
Rent	12.0	12.1	12.2	12.4	12.6	12.9
Other	19.0	19.6	22.2	24.0	26.4	28.4
	99.3	118.2	122.8	126.5	131.4	135.9
Gross profit (€ '000)	(11.2)	117.8	300.4	489.0	669.5	757.0
Overheads	(191.5)	(202.1)	(197.8)	(199.3)	(201.6)	(204.5)
	(202.7)	(84.3)	102.6	289.7	467.8	552.5
EBITDA	(202.7)	(84.3)	102.6	289.7	467.8	552.5
Depreciation	(3.6)	(4.1)	(4.1)	(4.1)	(4.1)	(4.1)
	(206.3)	(88.4)	98.5	285.6	463.7	548.4
EBIT	(206.3)	(88.4)	98.5	285.6	463.7	548.4
Interest Loan	(10.50)	(12.02)	(15.20)	(13.70)	(10.30)	(5.15)
Loan commitment fees	(0.65)	0.00	0.00	0.00	0.00	0.00
Interest income	1.22	0.05	0.09	0.96	3.10	6.48
	(216.2)	(100.4)	83.4	272.8	456.5	549.7
EBT	(216.2)	(100.4)	83.4	272.8	456.5	549.7

3.4. Development of Business Model Canvas

Business Model Canvas (BMC) is a graphical representation of the basis of the business. The nine basic building blocks show how VFC plans to be a profitable and sustainable online platform in the long run. The nine blocks cover four key areas of the VFC business: (a) customers, (b) supply, (c) infrastructure and (d) financial viability, and this is why it was selected as the preferred representation of the VFC business model.

Composing all the above basic elements for VFC, we conclude to present the Business Model Canvas developed for the VFC platform. The seamless implementation of the proposed BMC will ensure the long-term viability of the platform and can be also applied in other similar businesses. The proposed BMC is depicted in Table 4.

Table 4. VFC Business Model Canvas (source: Authors' survey).

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
			Customer reward programs;	
Logistics and warehousing market consultants;	Registration and mapping of available storage spaces;	Quick and easy finding of suitable storage facilities;		All types and sizes of companies looking or searching for warehouse spaces, with an emphasis on e-commerce businesses;
			24 h telephone service;	
Research institutions specializing in logistics;	Supply and demand matching;	Dynamic database of available storage spaces and logistics services in Greece;		Companies with excess storage capacities;
			Workshops for the familiarization with the VFC platform;	

Table 4. Cont.

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
Marketing & advertising consultants;	Collection and analysis of market data;	Providing a tool to support the design and management of a business storage network;	Ability to provide personal training on the services of the VFC;	Warehouse owners;
Technology providers.	Dynamic Contracts support;	Providing the possibility of smart and fair pricing of storage spaces, satisfying all involved (fair pricing);		Warehouse equipment supply companies;
	Platform maintenance.	Improving the visibility of the warehousing market, the available storage spaces and their characteristics in Greece.		Warehouse consulting companies;
	<u>Key Resources</u> Excellent knowledge of the warehousing market; Fair pricing and intelligent matching algorithm;		<u>Channels</u> Website;	Non-logistics market.
	Design and support of the platform;		Advertising in means of the logistics sector; Social networks;	
	Shared capacity model -community.		Communication sponsors in logistics conferences;	
			Direct presentations to companies (e.g., Power breakfast).	
<u>Cost structure</u> Employee salaries; Cost/depreciation of technological equipment; Website/Software/Hardware: update/upgrade/maintenance; Advertising/promotion costs.			<u>Revenue streams</u> Transaction fees; Subscription fees; Revenue from lease agreements; Market analysis reports; Third party advertising.	

4. Discussion

This paper performs a business model analysis of a smart city logistics solution, the first on-demand warehousing e-marketplace in Greece. Recent advances in the technology sector and the increased need for responsiveness from businesses to customers, have created the conditions for a wider adoption of the sharing economy and the subsequent emergence of then on-demand platforms and their respective business models. The present research captured the existing warehousing business models and the corresponding needs in the Greek market by addressing the current challenges in adopting on-demand warehousing solutions. The paper resulted in a clear and detailed description of a picture of the business model developed by VFC, mapped in nine blocks of the Business Model Canvas. The value proposition offered by the VFC is an on-demand digital platform that offers significant

benefits to its two kinds of users, the users-buyers and the user-sellers that have unpredicted warehousing needs in their business. This paper also provides a robust revenue and expenditure model developed for the VFC in order to ensure its long-term viability in a constantly growing and fast changing environment.

The chosen methodology is not without limitations. First, the penetration shares and the revenue model are based on well-placed estimations, which can be very sensitive to supply chain disruptions such as the current COVID-19 pandemic. It is assumed, though, that starting the operation of the VFC platform from 2022, the pandemic will be over and the forecasts will be as accurate as possible. In any case, a COVID-19 resistance scenario has also been developed, but the continuation of extreme conditions is out of the scope of this paper.

5. Conclusions

The purpose of this paper is to present a business model analysis for digital platforms by using the case of the first on-demand warehousing platform in Greece. The massive increase in e-commerce and the consequent evolution of the sharing economy to respond to such an increase created the need for new innovative business models in order to enhance the long-term sustainability and economic viability of such e-marketplaces. The results for the Greek market show that although there are a lot of challenges to be addressed, there is enough space and remarkable opportunities for new smart solutions in the logistics and warehousing sector that can be viable in the long-term. The present paper concludes by presenting the business model developed by the VFC, using the Business Model Canvas tool, showing clearly the identified content on the nine blocks of the BMC.

Author Contributions: The conceptualization of the present research was done by G.A. and L.P. The methodology was developed by G.A. and the validation of the work was accomplished by E.X., G.T. and O.T. The original draft preparation was done by L.P. while the review and editing process was done by E.X. under the supervision of G.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH—CREATE—INNOVATE (project code: T1EDK-04383).

Institutional Review Board Statement: Not applicable.

Data Availability Statement: 3rd Party Data Restrictions apply to the availability of these data. Data was obtained from Planning S.A., subcontractor of the project, and are not available.

Conflicts of Interest: The authors declare no conflict of interest.

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