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Resourceedings Proceedings of Science and Technology

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ISSN (Print: 2537-0731, online: 2537-074X)

International Journal on:

Proceedings of Science and Technology

DOI: 10.21625/resourceedings.v3i1.950

Innovative Business Models for the Future Smart City

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Abstract

This paper examines how to outline and adopt innovative business models for the Smart Cities of the future. Smart Cities are intelligent and efficient communities and ecosystems employing digital technologies to respond a growing waste of resources, unsustainable environmental impact, and inefficiency in traditional processes. Considering the greatest benefits of Smart Cities on economies, societies, and environment, many countries have now introduced national Smart City projects in order to transform life, improve business operations and market competitiveness. However, despite growing interests towards Smart Cities, it remains still difficult to adopt this paradigm due to digital transformation, interaction strategies, social and cultural problems. Therefore, this paper aims to break down the barriers to these problems and support the literature and management to understand how to implement profitable business models for Smart Cities of the future. Specifically, we identify four main areas characterizing Smart Cities (i.e., Smart Mobility, Smart Living, Smart Energy, and Smart Public Ecosystems) where digital technologies have shown greater progress with large savings. For each area, multiple case studies have been discussed and Business Model Canvases have been developed for generalizing effective methodological approaches toward efficient implementation of Smart City paradigm. Results are threefold. As for digital transformation problems, we show how digital technologies (e.g., Cloud, IoT, Big Data and AI) are applied profitably through innovative business models; as for interaction strategies problems we indicate how to organize innovative ecosystems involving public and private actors to promote Smart Cities; as for social and cultural problems we delineate change management and communication practices useful to instill in all stakeholders a culture towards the Smart City. With these findings the paper aims at enriching scientific knowledge about the Smart City Paradigm by means of a business model perspective and to offer public administrations insightful guidelines for the transition toward Smart Cities.

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Keywords

Future Smart City; Business Model Canvas; Digital Transformation; Innovation Management

1. Introduction

The development of modern industry since the late 18th century and the ever-increasing globalization produced massive urbanization. This led to the growth of new large cities all over the world, opening the way towards strong interventions and actions for transforming cities into Smart Cities. These are characterized by investments in innovation and change management, aimed at applying new digital technologies in different areas and sectors.

This paper fits into this context and is aimed at outlining innovative business models for the Smart Cities of the future, understood as smart and efficient communities and ecosystems that use digital technologies to respond to the growing waste of resources, unsustainable environmental impact, and inefficiency of traditional processes. In fact, despite the growing interest in Smart Cities, it remains difficult to adopt this paradigm due to digital transformation, interaction

strategies, and social and cultural problems (Aurigi and Nance, 2022). Therefore, the paper aims to break down barriers to these problems and support literature and management in understanding how to implement profitable business models for Future Smart Cities. Specifically, four main areas that characterize Smart Cities were identified. For each of them, innovative business models and strategies were identified from multiple case studies that are most appropriate for solving problems related to digital transformation (e.g., how to integrate digital technologies into innovative business models for Smart Cities), interaction strategies (e.g., how to organize innovative ecosystems involving public and private actors to promote Smart Cities), and society and culture (e.g., how to instill in all stakeholders a culture toward Smart Cities through change management and communication practices).

With these findings, the work aims to enrich scientific knowledge on the Smart City paradigm through a business model theory-based perspective and offer in-depth guidelines for governments to transition to Smart Cities.

2. Theoretical Background

Smart Cities are intelligent and efficient communities and ecosystems employing digital technologies to respond a growing waste of resources, unsustainable environmental impact, and inefficiency in traditional processes (Albino, Berardi, Dangelico, 2015). Smart Cities have a positive impact on economies, societies, and environment; therefore, many countries have now introduced national Smart City projects in order to transform life, improve business operations and market competitiveness. Specifically, four main areas characterizing Smart Cities are identifiable.

Despite growing interests towards Smart Cities, it remains difficult to adopt this paradigm. In fact, problems related to digital transformation (Hämäläinen, 2020), interaction strategies among public and private actors (Ismagilova et al., 2022), and social and cultural problems (Monfaredzadeh and Krueger, 2015) are factors that have to be solved to increase the diffusion of Smart City in the actual period. These problems can be solved through the recent proliferation and updating of new digital and enabling technologies (e.g., Cloud, IoT, Big Data and AI) that generate different and important impacts on the innovative business models of cities (Balakrishna, 2012).

Currently (Gordijn, Jaap, and Hans Akkermans. 2001), within the literature for the analysis of business models for Smart Cities (Díaz-Díaz et al., 2017) is recognized the Smart City Business Model Canvas (SC-BMC), also called City Model Canvas (CMC), that is used as a framework to support the creative development, visualization and communication of business model innovations sustainable development of Smart Cities. The SC-BMC is based on the original concept of Business Model Canvas[1] (Osterwalder, Alexander, 2022), applied to organizations driven by more than just economic profit, thus showing the elements that public administrations should consider when designing, delivering and evaluating intelligent services. Specifically, SC-BMC adds two further layers to the original Business Model Canvas, i.e., an environmental layer based on a life cycle perspective, and a social layer based on a stakeholder perspective (Sparviero and Sergio, 2019).

Despite these findings, contributions to new emerging trends for business model for the Future Smart Cities (Sepasgozar, Samad ME, et al., 2019) are appearing as a collection of small and disparate research streams with little theoretical and empirical integration. A company's Business Model Canvas may ignore aspects such as social welfare and process sustainability. Exemplary are "Yokohama Smart City Project"[2], Tokyo and Chinese model cities, which look carefully at social and cultural processes related to sustainability, establishing precise strategies for interaction and shared responsibility. Difficulties have emerged in adopting the Smart City paradigm due to the digital transformation, interaction strategies, and socio-cultural issues. (Allam, Zaheer, and Peter Newman, 2018). Based on this assumption, the main objective of this work is to identify patterns of innovative business models for Smart Cities, enabled by technologies advanced technologies, that generate progress and interconnection to cities, eventually offering guidelines for local administrators and governors to conduct innovation of business model for Future Smart Cities.

[1] The Business Model Canvas is a strategic tool that uses visual language to create and develop innovative business models: it represents how a company creates, distributes and catches value

[2] https://www.city.yokohama.lg.jp/lang/overseas/climatechange/contents/energypolicy/yscp.html

3. Research Methodology

Research question was addressed using a multiple case study approach (Piekkari and Welch, 2018) for theory formation (Eisenhardt, 1989). Specifically, four cases of both companies and governments business model innovations in Smart City contexts were selected (i.e., Mantua in collaboration with Bosch, ARKAPPA, Acmei, Wien) according to two sampling criteria.

First, the cases in question reflect the value mechanisms of both well established companies, Small and Medium-sized Enterprises, startups, and governments that have acted as pioneers in innovation in Smart City context. Second, the cases analyzed belong to different context shaping Future Smart Cities, from transportation to energy, from housing to the public ecosystem. In this way, the cross-cutting nature of success factors for innovative business models is captured by the Administrator as a guideline for actions to be implemented for Future Smart Cities, by acting on Smart Mobility (Xu and Zhaolin, 2022), Smart Living (Han et al., 2021), Smart Energy (Mosannenzadeh et al., 2017), and Smart Public Ecosystem (Osterwalder and Pigneur, 2019).

After sampling, data collection was conducted. Specifically, statistics for know-how enterprise context were taken from company websites, firms' newsroom sections, and enterprise reports. Alongside to this, documentary statistics deriving from newspapers (Toh, Chai K, et al, 2020), and social media pages (e.g., YouTube, LinkedIn, Facebook profiles) had been used to study the impact of Smart Cities.

Collected data were triangulated to provide a robust description of the cases, first analyzed as single independent instances and then as components of a cross-case evaluation. In particular, the rigorous case-by-case analysis was supported by SC-BMC framework. Instead, cross-case analysis was accomplished through comparative tables summarizing similarities and differences between the evidence found.

Below presents the profile of the cases analyzed.

3.1. Parking pilot project in Mantua in collaboration with Bosch[3]

The case analyzed in Smart Mobility context was the smart parking pilot project established in Mantua, thanks to the use of 66 Bosch sensors, installed in one of the main streets of the city center. It is possible to check the availability of parking spaces through the use of an application, as well as directly pay through the app and simply extend the scheduled parking time when it is over. A partnership with the public administration is needed in this model business model, since if a car remains parked for a longer time than already paid, sensors report it to the nearest traffic police station.

3.2. Smart Buildings in ACMEI[4]

In the Smart Living context, an exemplary success case of companies operating in the field of smart buildings is ACMEI, an Italian company which manufactures technological systems and a wide range of products for their installation and maintenance of the same, addressing both industry operators such as construction companies, installers electrical, plumbing and heating engineers. The company targets both industry professionals such as construction companies, electrical installers, and plumbers, as well as planners such as designers, architects, and engineers, but also end users who want to directly install the company's solutions inside their homes or offices. In addition, ACMEI provides a real energy consulting service, and on the private front, it also offers individual solutions related to home automation, control, and centralization of smart devices such as home cinemas and smart thermostats. It also offers solutions integrated for the installation of photovoltaic panels with smart management of air conditioning of buildings and energy.

3.3. Smart Water Metering in APKAPPA[5]

In the Smart Energy context, the Italian company APKAPPA was analyzed, which, applying a water metering model, provides a radio logger designed for remote reading and remote control of water meters. This product transmits reading data in digital format directly to the central acquisition system, saving time and resources for the end consumer by avoiding a series of intermediate steps provided by traditional meters. The company also offers a platform enabling

the acquisition and management of a large amount of data from different sources, storing it and then making it available for processing activities and predictive analytics. Thanks to a cloud architecture, it is easily accessible with any mobile device connected to the Internet and the software easily connectable to the radio logger systems, making it even more straightforward for the customer to prepare financial statements water or the detection of anomalies.

3.4. Smart Government in Wien[6]

In the Smart Public Ecosystem context, the case analyzed is an application used in the city of Wien, the first city to have designed and implemented an all-inclusive Smart City strategy framework supplemented by a digital agenda, in which in which the strategy is updated from time to time based on the monitoring of results. Wien established a central coordinating body, the Smart City Agency, dedicated to coordinating Smart City-related projects and their monitoring, thus leading the city to highly integrated solutions for mobility, environment education, Public Administration, and healthcare. Of note is "The Sag's Wien" application, which facilitates the direct communication between citizens and public administration via text messaging, reducing the time of communication between the parties and allowing citizens to report problems, such as hazards or sources of danger.

4. Findings

4.1. Smart City Business Model Canvas for Smart Mobility

In the context of Smart Mobility, we reconstruct a SC-BMC (Figure 1) from the case analysis of the pilot project fielded by the City of Mantua in collaboration with Bosch, contrasted with adequate literature. (Shin, Jong-Ho, and Hong-Bae Jun.,2014).

We consider an enterprise that wants to offer a Smart Parking service to its users via app for smartphones, the main value propositions are the help in finding parking, which avoids unnecessary turns and the reliability of the data provided by the sensors, which are monitorable and real time. The model analyzed is therefore mainly aimed at private users, drivers of all ages especially parking-conscious, thus mostly living in large urban centers or already use parking payment apps. The app represents the main channel used by the service for all functionalities: support, reporting, feedback. Fundamental turns out to be the activity of promotion and sponsorship, online and physical, as well as potential guerrilla campaigns marketing in the most congested areas of large urban centers to attract attention just as users search for parking. Revenues are generated from the percentage on parking payments and from any additional subscriptions or packages, such as flat subscriptions on parking in a particular area of the city or the ability to reserve a parking space. Key activities include the installation and maintenance of the sensors and hardware infrastructure, which are also the key resources of the model. Considering partnerships, in addition to the necessary ones with suppliers, the following may be interesting and potential partnerships with municipalities or large commercial centers, which can serve as the first investors and financiers in the model. Costs, on the other hand, are represented and incurred for sensors, infrastructure, the development and maintenance of the application, for personnel, but especially for the activities of marketing and advertisement for rapid and widespread dissemination of the service.

[3] https://www.bosch-press.it/pressportal/it/it/press-release-41216.html

[4] https://www.acmei.it/ita/home

[5] https://www.apkappa.it/it-it/home

[6] https://www.wien.gv.at/sagswien/

<table>
<tr>
<td rowspan="2">Key Partners

-Suppliers (sensors)
-Sensor installation services
-Large shopping centers
-Investors
-Municipalities
-Research and development organizations (for Innovation and open innovation)
-Service Designers
-Compliance experts
-Cyber security experts</td>
<td>Key Activites

-Installation of sensors in dedicated areas
-App and platform development and maintenance
-Research and development
-Research for new areas to attack
-Marketing
-Advertising</td>
<td rowspan="2">Value Proposition

-Helps users find a parking space easily
-Uses real time data provided by sensors
-Saves time and fuel for users
-Smooth solution for parking search and payment
-Reduces emissions of gas pollutants.
-Reduces traffic congestion in the city</td>
<td>Customer Relationships

-Customer feedback
-Support</td>
<td rowspan="2">Customer Segments

Private users:
-Drivers in large urban centers or in usually busy areas
-Drivers already using parking payment apps</td>
</tr>
<tr>
<td>Key Resources

-Sensors
-User Location
-Application
-Hardware Infrastructure</td>
<td>Channels

-Mobile marketing
-Influencer marketing
-Online advertising</td>
</tr>
<tr>
<td colspan="3">Cost Structure

-Cost of platform
-Cost of infrastructure and hardware
-Cost of Maintenance
-Cost of Marketing and Adv
-Cost of personnel</td>
<td colspan="2">Revenue Streams

-Percentage on parking payment
-Subscriptions for additional services</td>
</tr>
<tr>
<td colspan="3">Environmental Costs

-high CO2 emissions</td>
<td colspan="2">Environmental Benefits

-reduced emissions (less time searching for parking)</td>
</tr>
<tr>
<td colspan="3">Social Costs

-Frustration and non-value-added activities (having to stay in the car)</td>
<td colspan="2">Social benefits

-Serenity and more time to spend on activities with value</td>
</tr>
</table>

Figure 1 SC-BMC Smart Parking – Smart Mobility

4.2. Smart City Business Model Canvas for Smart Living

In the context of Smart Living, the case of ACMEI and literature on the track (Haque, AKM Bahalul, Bharat Bhushan, and Gaurav Dhiman,2022) allowed the reconstruction of the SC-BMC presented in Figure 2. We consider an enterprise active in the market related to Smart Buildings, specifically a company that offers customized consulting services for the implementation of Smart systems on existing or new buildings, it can be seen that a high level of know-how and third-party hardware, positioning itself as a service provider of installed devices in managing the entire ecosystem. Specifically, the main value proposition is the design of a smart environment for new buildings or retrofits of existing buildings. It is also planned to provide a dedicated team with the company's know-how and a customizable proprietary platform that includes dashboards for monitoring facilities, access, cameras and structures, as well as possibly being linked to waste management systems and integrated with smart lighting. The target customer segments are mainly businesses operating in the construction such as construction companies, facility installation and maintenance services, architects, designers, engineering firms. However, other solutions can be implemented in the canvas to extend some services to end users as well, leveraging the existing environment and know-how consolidated at a later stage. The main and potential channel could be an innovative physical store that, through the use of virtual reality and augmented reality, allows the user experience to be taken to another level, displaying key machine Key Performance Indicators through holographic viewers, providing an experience immersive to the potential customer even in spaces such as trade fairs, exhibition halls, or stores with a small size.

<table>
<tr>
<td rowspan="2">Key Partners

-Suppliers (hardware, IoT devices, sensors)
-Cloud Services
-Engineering companies
-Consulting firms
-Public administration</td>
<td>Key Activites

-Design and development of smart buildings solutions.
-Research and development
-Design, design and development of the platform
-Partner research for hardware procurement and third-party management</td>
<td rowspan="2">Value Proposition

-Realization of highly complex projects in the Smart Building field.
-Consulting on hardware procurement and design and Maintenance.
-Dedicated team per Project
-Proprietary platform that can be customized as needed
-High knowledge of the industry and profiles to provide support that meets customer expectations</td>
<td>Customer Relationships

-Direct (website, phone, email, offices)
-Dedicated (project manager per job order)
-Indirect (app support, platform support, FAQ)</td>
<td rowspan="2">Customer Segments

-Construction companies
-System installation companies (energy, plumbing, thermal, photovoltaic, etc.)
-Professionals (architects, designers, etc.)
-Engineering companies
-Municipalities and public administrations</td>
</tr>
<tr>
<td>Key Resources

-Know-how
-Highly specialized team of engineers
-Proprietary platform
-BDA management experts
-API management experts
-Cyber security experts</td>
<td>Channels

-Physical stores
-Fairs and exhibitions
-Advertising</td>
</tr>
<tr>
<td colspan="3">Cost Structure

-Personnel costs
-Research and development costs
-Platform Development and Maintenance Costs
-Supplier costs
-Advertising
-Hardware for exhibits</td>
<td colspan="3">Revenue Streams

-Project implementation and sales
-Project consulting and upselling
-Costs of customizing the platform
-Yearly fees on the use of the platform</td>
</tr>
<tr>
<td colspan="3">Environmental Costs

-CO2 Emissions, low-quality material (use and disposal)</td>
<td colspan="3">Environmental Benefits

-Reduced CO2 emission and pollution</td>
</tr>
<tr>
<td colspan="3">Social Costs

-Quality of life, climate change</td>
<td colspan="3">Social benefits

-Economic savings and better quality of life (at home)</td>
</tr>
</table>

Figure 2 SC-BMC – Smart Building –Smart Living

4.3. Smart City Business Model Canvas for Smart Energy

In the context of Smart Energy, Figure 3 presents the SC-BMC built from the case of APKAPPA and consistent literature on the topic (Munir, M. Safdar, et al., 2018). The SC-BMC is aimed at a company offering sensors for the development of a platform that enables the interpretation and reading of data collected by the hardware, having as its value proposition the benefits related to smart water metering such as reduced costs and effort related to meter reading, better awareness regarding the consumption of the user end user, better management of the data network in real-time, and detection of technical losses thanks to predictive maintenance. In particular the key resources are obviously the suitable sensors and platform, along with the personnel and cybersecurity experts, who will have to take care of defending and keeping customer data secure. Among the customer segments, there are infrastructure related to water supply such as water supply managers and local entities, for whom the management of a resource indispensable for human life is optimized, thus reducing environmental costs and wasting.

<table>
<tr>
<td rowspan="2">Key Partners

-Partner companies for the implementation of the platform
-Partner companies for the supply and implementation of ad hoc sensors
-Consulting companies
-State and government agencies
-Local police</td>
<td>Key Activites

-Design of a digital ecosystem capable of interpreting the data collected by sensors.
-Data analysis and AI training for decision making purposes (sending alerts, closing conduits, Predictive Maintenance, etc.)
-Sales
-Research and Development</td>
<td rowspan="2">Value Proposition

-Reduction of costs and efforts related to meter reading.
.Improved end-user awareness regarding their consumption
-Better management of the data network in real time.
-Detection of technical losses and Predictive Maintenance.</td>
<td>Customer Relationships

-Dedicated customer support
-Dedicated startup consulting
-Dedicated project manager</td>
<td rowspan="2">Customer Segments

-Municipalities
-Government agencies
-Public water supply infrastructure.</td>
</tr>
<tr>
<td>Key Resources

-Brand
-Service Design
-Brevets and Sensors
-Digital Platform
-Skilled personnel
-Experts in cyber security</td>
<td>Channels

-Promotional materials (website, advertising,..)
-Social media
-Public conferences, fairs, workshops
-Ad hoc communication plan</td>
</tr>
<tr>
<td colspan="3">Cost Structure

-Research and Development
-Personnel costs
-Costs of raw materials
-Marketing
-Advertising</td>
<td colspan="3">Revenue Streams

-Asset rooms (sensors)
-Sales design and consulting
-Upselling (additional functionality on platform)
-Eventual abundance for service use.</td>
</tr>
<tr>
<td colspan="3">Environmental Costs

-Waste of water</td>
<td colspan="3">Environmental Benefits

-Use of right way water present in nature</td>
</tr>
<tr>
<td colspan="3">Social Costs

-Poor countries could reduce their limitate access to water</td>
<td colspan="3">Social benefits

-Maintain enough water also if the population is increasing</td>
</tr>
</table>

Figure 3 SC-BMC – Smart Water Metering –Smart Energy

4.4. Smart City Business Model Canvas for Smart Public Ecosystem

In the context of the Smart Public Ecosystem (Anthopoulos, Leonidas G., 2017), we take the case of Smart Government in Wien to build the SC-BMC presented in Figure 4. The business model revolves around an app to connect citizens and the respective municipality, enabling the flow of information from the bottom up and lowering the detection time of any problems present in the city. The value propositions are many: the significant savings in time for users first and foremost, plus the platform enables the collection, storage and analyze data to evaluate them more easily; in addition, the data are usable for all, making the activities much more transparent but, at the same time the privacy of the citizens by making sensitive data accessible only after accreditation; finally, thanks to the data provided on mobility and energy, it is possible to build models and provide solutions to specific problems. The customers targeted by the app are citizens, administrators, universities, research institutes, and businesses. Regarding the issue of cost, it costs are necessary for implementing and building the platform, then maintenance, and development of new functions, as well as costs for storing data in the cloud, are expected.

<table>
<tr><td>Key Partners

-Consulting firms
-State and government agencies
-City communities
-Developers for additional solutions</td><td>Key Activites

-Platform design.
-Data analysis and AI training for decision making purposes (sending alerts, detenction of problems)
-Research and Development

Key Resources

-Brand
-Service Design
-Digital Platform
-Skilled personnel
-Experts in cyber security</td><td>Value Proposition

-Saves time in detecting issues in the city.
-Collection and analysis of data inherent in smart city use.
-Transparent yet secure data through authentication
-Open platform</td><td>Customer Relationships

-Automatic (platform)
-Autonomous (FAQ, guideline)
-Dedicated (in the start-up phase)

Channels

-SMS
-App
-Adv
-City Marketing</td><td>Customer Segments

-Municipalities
-Governmental bodies
-Metropolitan Areas</td></tr>
<tr><td colspan="3">Cost Structure

-Research and Development
-Personnel costs
-Platform Development and Maintenance Costs
-Marketing
-Advertising</td><td colspan="2">Revenue Streams

-Sale of the service to cities, via annual subscription
-Advertising on the platform</td></tr>
<tr><td colspan="3">Environmental Costs

-CO2 emissions, wastes (g.e. papers, plastic)</td><td colspan="2">Environmental Benefits

-Reduced CO2 emissions, wastes</td></tr>
<tr><td colspan="3">Social Costs

-Time lost and frustration</td><td colspan="2">Social benefits

-Serenity and more time available for value-added activities</td></tr>
</table>

Figure 4 SC-BMS – Smart Government –Smart Public Ecosystem

5. Discussion and Conclusion

After analyzing each of the four areas the business models innovation in Smart City through case studies, we provide a handbook-style guide for the administrator showing how to implement innovation towards Future Smart Cities by overcoming barriers related to digital transformation, interaction strategies, and social and cultural problems. Specifically, we identified and summarized common external and internal success factors and strategies that can be adopted by governing bodies and policymakers in the Smart City in the success formula (1) as follows:

$$y = f(x) = X1 * X2 * X3 * X4 * X5 * X6 * X7 * X8 \quad (1)$$

Success Factors for the administrator toward the Future Smart City

Y=F(X)	Success Factors of the Objective Function
X1	IoT e Cloud
X2	AI e Big Data
X3	Cooperation
X4	Funding
X5	Human Resources
X6	Trust
X7	Innovation
X8	Environmental Sustainability

To enable the transition from City to Smart City, the following factors appear crucial. Enabling technologies, represented by the first two factors (X1 and X2) and act as enablers and facilitators in the transformation process of cities, represented in particular by IoT, Cloud, AI, Big Data (Balakrishna, 2012) and all the infrastructure that enables their application. These technologies thus enable the generation of new business models for smart urban solutions in a wide variety of domains, from security to healthcare, mobility to energy, water to waste, and community to strategic engagement and interaction mechanisms. In the specifics of success factor X1, Cloud platforms are becoming increasingly essential to any data storage and archiving process and IoT technologies are becoming more prevalent in every domain (Mitton, Nathalie, et al., 2012). A first example is connectivity technologies such as broadband Wi-Fi connections, 5G technology, sharing networks related to sharing mobility that improves citizens' quality of life. Another example is IoT sensors, which are the main enabling technology for Smart Cities, as they enable the cost-effective acquisition of a large amount of data that, once processed, can be used for administrator decision making. In addition, the successful role for Smart City Administrators of the future is played by the application of Big Data and Artificial Intelligence (Allam, Zaheer, and Zaynah, 2019). Identified in X2, in a global context made of increasing complexity, the application in every domain of Artificial Intelligence is therefore essential (Singh et al., 2020). Artificial intelligence is defined as the set of human-designed software and hardware systems that, given a complex goal, act in the physical or digital dimension by acquiring data, interpreting the collected data, processing the information derived from these data, and deciding on the best actions to take to achieve the given goal.

Represented by X3, cooperation (Dong, Yifan, et al, 2019) also in the context of the Smart City assumes an important and decisive role in every field of application, which is also indispensable therefore for a guideline that an Administrator should adopt aiming at the effectiveness of the future Smart City. In particular, cooperation proves to be important, especially to overcome barriers related to socio-cultural problems and interaction strategies, to have a value co-creation approach. While the literature has previously analyzed the factor based on the theories of Nash (Nash, 1951) and cooperative games and convenience to cooperate to achieve the most effective synthesis benefit, we take a more holistic view that considers business model innovation, demonstrating how the success of Smart City projects and applications, is largely based on supporting decision-making by incentivizing social and cultural cooperation and various technologies. In the case of Smart Cities, business modeling thus requires a network-centric value proposition that includes all ecosystem actors as cocreators of value (Mayangsari, Lidia, and Santi Novani, 2015). In the network-centric approach, a network of actors creates an integrated system, where the user value of the products or services produced is validated only if customers adopt the solutions. It is therefore critical for the administrator to develop value cocreation so that actors are involved at the beginning of the decision-making process, starting with problem identification, and have the opportunity to develop policies, programs, and improve services.

Another generic aspect that is important in every sphere and preparatory to solving all kinds of barriers that the Smart City Administrator must take into account and frame in the success factor in formula X4 is prevention and security of financial coverage (Tan et al., 2020), hence securing the right funding. It has been shown how finding and managing funding is the biggest challenge for administrators in implementing a Smart City, precisely because getting the enabling technologies and infrastructure therefore results in essential investments. (European Union's Horizon, 2022).

An additional aspect on which the administrator and policy maker must dutifully place their attention is human resource planning and management (Bakıcı, et al, 2013) represented in the formula by the factor X5 success factor. Future Smart City administrators are required to hire a sufficient number sufficient number of experts to make sure that the skills and network requirements are adequately in line with the project requirements. This all comes at a high costs and difficulties in the area of training and skills upgrading in e.g., Cyber Security, the use of IoT technologies, sensors, and devices connected. In fact, the high volume of connected devices, through IoT technologies need interventions by the administration aimed at the centralization of countermeasures, preventive and otherwise, in the area of cybersecurity. The administrator is therefore required to plan ongoing and preventive training and then also to design countermeasures security and preventive activities that would safeguard not only the data but also the community.

As depicted by success factor X6 in the formula, yet another useful aspect of solving and prevention of problems and barriers that emerged in each of the four areas of application and development of a Smart City is the establishment of trusting relationships (Cooper, et al, 2008) to be able to optimize the benefits public toward a balancing tradeoff between trust and privacy. This was evident from case analyzed by Neupane, Chiranjivi, et al. in "A trust-based model for the adoption of smart city technologies in Australian regional cities." In 2021. Many decisions by administrators will be made based on data collected by sensors and processed later by Artificial Intelligence (AI) and some interventions suggested by AI systems may be the result of errors, malfunctions or system bugs, thus recommending unnecessary interventions and sometimes also creating inefficiencies for the citizenry. If a problem occurs, it could generate insecurity, confusion, and loss of confidence in the citizenry, which is therefore important to keep "trained" and on a good level by the Administrator for effective action to mandate. Reinforcing this thesis is also delicate and sensitive for some citizens, an issue of social origin, concerning the privacy of the population. The Administrator of the Future Smart City should ensure a balance between quality of life and privacy violation, because while everyone wants to enjoy a more convenient, peaceful, and healthy environment, hardly anyone would like to feel constantly "monitored".

Another aspect to be considered as a constant guideline for the administrator concerns innovation (Nam, et al. 2011) and is represented in the formula by the success factor X7. Emblematic and explanatory turns out to be the case of Amsterdam (Putra, et al, 2018). The Future Smart City administrator must be aware that triggering factors that generate innovation will also generate greater competitiveness because innovation helps the economic system to be competitive. Interesting relationships that the Administrator should monitor and emphasize in this analysis are those between innovation and organization and creativity and innovation, considering that innovation is created through organized creative processes. Innovation is then influenced by other variables, namely serendipity and creativity, organization, and then updating updates on new technologies of Internet of Things, Big Data, Cloud, 5G, Artificial Intelligence, Cybersecurity, Blockchain, and FinTech.

A last, but not least, aspect to be kept in mind by the Administrator in a Future Smart City context has already been abundantly explored in the work and is the sustainability, with particular reference to environmental sustainability (Toli, et al, 2020), as indicated in the formula by the X8 success factor and emerged from the case of Kitakyushu (Chatfield, e al, 2016). Here, the SC-BMC with the analysis of a special section on socio-environmental sustainability, emphasized the importance of this topic for Smart Cities.

Going into the guiding formula for the Future Smart City Administrator, each of the success factors contribute to breaking down one or more of the three barriers of digital transformation, interaction strategies, and social and cultural problems for the innovation of business models in Future Smart Cities, as indicated in in the following table.

Table 1.Link and dependencies between objective function success factors and barriers to Future Smart City

Success Factors		**Barriers to the Future Smart City**		
		Digital Transformation	Interaction Strategies	Social and Cultural Problems
X1	IoT e Cloud	X	X	X
X2	AI e Big Data	X	X	X
X3	Cooperation		X	X
X4	Funding	X		

X5	Human Resources		X	X
X6	Trust		X	X
X7	Innovation	X		
X8	Environmental Sustainability	X		

5.1. Concluding Remarks

The paper gives more grounding to the use of the SC-BMC (Giourka et al., 2019) through analysis of four cases that are innovating to move toward the Smart City paradigm alongside the four main areas of Smart Mobility, Smart Living, Smart Energy, and Smart Public Ecosystem. The work allows the barriers related to digital transformation, interaction strategies, and social and cultural problems to be solved by the formula identified as the objective function, with the eight success factors guiding the administrator, The work is also subject to limitations and future research by having to test the same formula in different contexts. Picking up on what has already been stated about innovative and Future Smart Cities (Schaffers, Hans, et al., 2011) and their positive impact on economies, societies, and the environment and given the few and disparate streams of research with little theoretical and empirical integration (Carter, Michelle L., 2018) inherent in business models on Future Smart Cities, this paper can make a strong theoretical contribution. Specifically, the paper sinks in a comprehensive understanding of business model design for Smart Cities and then systematically assess the aspects that lead to successful trade-offs and increased effectiveness of smart solutions for the community. In 2022, the Administrator must be able and have all the tools, knowledge and skills to transform their city into an effective and efficient Smart City by analyzing trade-offs in every public sector of interest and offering Smart solutions to private individuals for every service of interest.

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