

RESEARCH

Open Access



# Emerging technological innovation in Gaza Strip municipalities: an entrepreneurial approach

Ashraf Y. AlAstal<sup>1\*</sup> 

\*Correspondence:  
Ashrafy.a@ieee.org

<sup>1</sup> Business and Technology  
Incubator, Islamic University  
of Gaza, Gaza, Palestine

## Abstract

To boost corporate efficiency in both the public and private sectors, innovation is fundamental. Efficient technological transfer and the role of public–private sector collaboration play a major role in the modern growth of knowledge-based economies. As a public service organization, municipalities normally coordinate with all partners to draw up strategies and use them in communities. A new vision is needed for the Gaza Strip municipalities, where all public and private stakeholders work together to co-design and co-develop new cutting-edge products and services aimed at generating shared value through entrepreneurial behavior. However, concrete examples of smart city projects revealed that municipalities often do not have the necessary capabilities as well as innovative approaches to collaborate with start-ups and other stakeholders' ecosystems. So, this paper aims to analyze innovation in the municipal sector shedding light on the barriers and challenges that municipalities in the Gaza Strip face in smart city development. This study uses primary data gathered from various stakeholders through focus groups, semi-structured interviews, and webinars to conclude how the Gaza Strip municipalities can work to address challenges in the smart city context; and to explore how to promote an ecosystem of entrepreneurship and innovation to support the adoption of new hi-tech technologies in the municipal sector. The Gaza Strip municipalities need to offer the necessary conditions for entrepreneurial talents who can bring their creative mindset, and technological experiences to the table, making it possible to build the best teams to solve any challenge. The research also concluded that Open Innovation Platforms can be seen as an important tool for enabling start-ups and researchers to develop innovative Hi-Tech solutions.

**Keywords:** Municipalities, Public sector, Open innovation, Entrepreneurship, Technological start-ups, Emerging technologies

## Introduction

While most public sector organizations are currently slow to adopt new technologies (Orton-Jones, 2018), the world is evolving, and more organizations are starting to see the importance of transferring to emerging technology even before they face any causes. In the public sector where there are budgetary constraints, legacy systems and resources are tight, the need for a well-thought-out IT strategy that aligns with business and public

objectives is crucial. Municipalities—as public sector organizations—usually coordinate with all stakeholders for setting plans and using them in cities. Municipalities have therefore to find alternative sources of capital and finance.

Municipalities in the Gaza Strip are in a dilemma; they have to improve services, invest in new infrastructure projects and increase revenues but they do not have the capital or finance resources needed to achieve these objectives. Almost 90% of the budget of municipalities came from local revenue collection. In the last five years however, municipal revenues have declined substantially due to the contraction in the economy. Palestine does not lack human capital to allow for the process of innovation, but the problem is the absence of an efficient environment that fosters the process and coordinates efforts and employs the capacities to achieve the best results (Taha et al., 2020).

The main objective of this research is to find a new vision for the municipalities in the Gaza Strip, whereby public decision-makers become public entrepreneurs to support the adoption of new hi-tech technologies. This can only happen through a mindset that relies on scientific research and an agile and tailor-made approach to new challenges. This approach will help to promote the creation of an ambitious municipal sector that can become a much-needed growth engine for the Palestinian economy. Therefore, this research aims to examine the technological entrepreneurship opportunities by looking at the challenges facing municipalities in the Gaza Strip area and develop an innovation framework that can influence the municipalities' innovativeness. The study explores the opportunity for cooperation between the creativity of the technological start-ups and the innovativeness of the municipal sector. The following section of this document shows the literature review for this study. Subsequently, the methodology is explained, and the main results are shown and discussed. Finally, the conclusion of this work is presented.

### **Technology-enabled municipal innovation**

The innovations appearing within the public sector are given special attention by researchers. A rich literature has been generated to study public sector innovation. Public sector innovation has been described as designing and introducing new processes, products, services, and delivery methods, leading to substantial changes in productivity, efficiency, or quality of performance (Mulgan & Albury, 2003). Serrat (2017) added that innovation is not an action or event; it is a concept, process, practice, and capability that distinguishes effective organizations. In short, innovation is the application of new ideas to produce better outcomes. Public service innovation efforts need to undergo several stages to achieve optimal implementation (Kusumasari et al., 2019).

In both the private and public sectors, innovation can be crucial to stimulating economic growth and development by reducing costs and improving services (Karakas, 2020). Kay and Goldspink (2013, 2016) conducted a series of separate studies and identified general discrepancies between public and private organizations. The researchers concluded that public sector performance is characterized by the department head addressing two factors. The first is the degree of confusion kept by the head of the department about the state of their organization and the political climate in which it operates. The second is the level of proactivity, whether the activity of innovation is part of the planned strategy and thus proactive or in response to an external stimulus (Kay &

Goldspink, 2013, 2016). Municipalities are public sector organizations. The municipal organization comprises an administration and departments, which organize and manage municipal tasks. Municipal organizations are responsible for providing many of the public services within their local city boundaries such as road repairs, cleaning and solid waste removal services, energy and water management, financial and tax collections, arts and culture, libraries, and other municipal tasks. Shearmur and Poirier (2016) explained how a municipality might resemble a business firm. It has a municipal (corporate) identity; it has a mayor (director), a council (board), administration, and departments. It also comprises citizens (clients) with whom interactions are necessary and from whom feedback is important.

Previous literature on technology innovation shows that technology infrastructure is a basic condition for the development of e-government and smart city actions (Przebylłowicz et al., 2018). Technology innovation includes the designing or improvement of new technological products, processes, and services that would benefit social, environmental, and/or economic functions within a municipality (Sawatzky et al., 2017). A more advanced technology environment would not only allow the organization but would also contribute to business and civil society innovation (UNECE, 2017). This means that by considering the economic, environmental, and social aspects of urbanization, technology and innovation can help achieve sustainable urban development.

Palestinian municipalities are responsible for planning public services and organizing cities. In the West Bank, there are 119 municipalities distributed through 11 governorates, meanwhile, in the Gaza Strip, there are 25 municipalities distributed through five governorates (MDLF, 2019). The capacity in the municipalities varies widely across their various kinds, depending on the resources available (Rammal & Abuoun Hamad, 2008). While the Palestinian municipalities have made tremendous progress in transferring conventional services to online services, due to budget and expertise constraints, there is still a long way to achieve seamless online services systems (MOLG, 2018).

Palestinian municipalities are familiar with using maps to figure out where to go, or how to plan city services through technology such as Geographic Information Systems (GIS). Access to GIS allows municipality workers to capture, store, manipulate, analyze, manage, and present spatial or geographic data (Waghmare et al., 2015). As municipalities increasingly rely on computer-based systems and data management, they need to work alongside technology providers to advance innovation and stay ahead of the technology curve.

Jaffal (2018) conducted research to highlight the challenges to digitalizing municipal services in Palestine; first, he pointed out that existing legislation regulating the local government and the ICT sector is obsolete and should be established by the local government sector under the newly adopted strategic plan (Jaffal, 2018 and Morar, 2018). Second, the dedication of the local government is a crucial factor, as the involvement of mayors and city council members in the role of the Community Service Centers (CMS) is currently restricting their role. The mayor and the city council members, therefore, must stick to the CMS Plan, which is intended to provide services to residents without administrative intervention. Third, in terms of staff capacity, problems could occur in municipalities because their workers may not have the resources to run an e-municipality or a CMS (Jaffal, 2018; Morar, 2018). Moreover, the staff members may be concerned

about losing jobs within the municipality because digitalization also requires process changes (Jaffal, 2018).

The Municipal Development and Lending Fund (MDLF), which introduced a range of capacity-building projects to strengthen the internal management of municipalities in the West Bank and the Gaza Strip, suggested the implementation of technology in municipal work (MDLF, 2009). This process was introduced through two stages; the first was to develop technical skills in the areas of finance, service and maintenance, registration of fixed assets, and information management. The second stage was to incorporate the latest software technologies to automate work through information systems (Jaffal, 2018). Considering the past of local government in Palestine, this was a crucial step towards a sustainable e-municipality climate.

In conclusion, public sector organizations (such as municipalities) and private sector organizations (such as technological start-ups) both want to implement digital solutions to solve problems in cities, but currently seem to do so with neither clear aims for their work nor proper follow-up procedures, with the risk of the implementations ending up having low, or even negative effects. Hence, there is a need for research that can support the implementation of emerging technologies and decision-making in this area, and this research aims to contribute to filling that need by looking at the challenges of municipalities in the Gaza Strip area and developing an innovation framework that can influence the municipalities innovativeness.

### **Entrepreneurship and municipal collaboration**

A range of studies mentioned significant barriers to innovation that need to be overcome in the public sector. Cankar and Petkovšek (2013) identified the absence of resources as the main barrier to innovation. This applies not only to the lack of financial resources, but also to the lack of expertise and staff. Jayasena et al., (2019) identified six strategies to overcome technology innovation challenges in the public sector in addition to the barriers. The researchers found that effective political strategy, the development of relevant policy, human capacity building, stakeholder management, effective communication, and private–public partnership are essential. Importantly, the barriers must be recognized before making decisions concerning technology development (Mazurkiewicz, 2018).

Traditionally, when implementing the latest technology and investment in innovation, the public sector is lagging behind the private sector. Public workers are inherently disappointed with their digital office technologies (Orton-Jones, 2018). A survey of 400 senior officials published by Eggers and Bellman (2015) observes that the public sector lacks the expertise and funding to provide digital public services effectively (Eggers & Bellman, 2015). To improve this case, the public sector organizations should focus on services it wants to deliver rather than developing products themselves and improving how it works with technology firms, large or small. The public sector must collaborate with private businesses to avoid missing new technology. The Institute of Directors (IoD) conducted two surveys in 2017 with 1887 respondents; the results show that 51% of the respondents say a new model is needed for engagement with SMEs and technology partners (IoD, 2018).

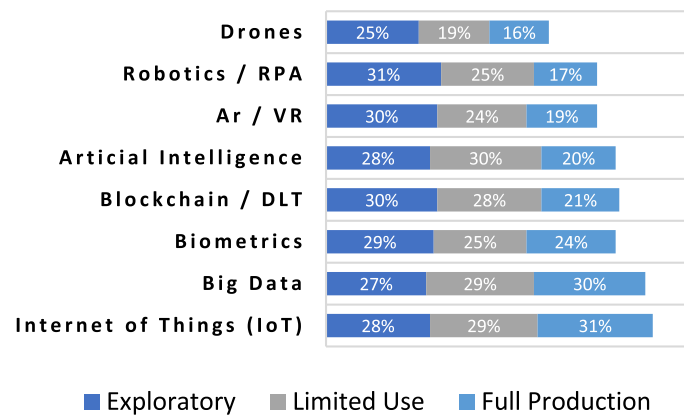
In Palestine, the private sector has been striving for economic survival for a long time, especially during the COVID19 crisis. This sector, which is composed largely of small and medium-sized enterprises, has not received adequate support from the Palestinian Government. Shahwan and Soudah (2005) conducted a study to investigate the kind of relationship existing between the public and private sectors in Palestine as perceived by a representative sample of the private sector using a structured survey that was distributed to 150 small and medium-sized enterprises in 2004. The results indicate a low level of cooperation between the two sectors, which is often based on mistrust or negligence. Hence, there is a need to improve the concept of public–private partnership in Palestine (MDLF, 2009). This will help to create confidence and trust between the various parties and enable the private sector to launch creative and profitable business ideas that will provide the necessary solutions to municipal challenges.

Innovation in Palestine could be classified as strong due to several factors such as the high percentage of youth in the population, abundance of highly educated and skilled Palestinians, and the increasing national interest in innovation and entrepreneurship (PITA, 2018). Palestine does not lack human capital to allow for the process of innovation, but the problem is the absence of a foster and efficient environment that fosters the process and coordinates efforts and employs the capacities to achieve the best results (Taha et al., 2020). For example, without a mechanism to link the outcomes of universities education and the market demands of local sectors, the gap will keep existing. This research examines the technological entrepreneurship opportunities through cooperation between the creativity of the technological start-up and the innovativeness of municipalities in the Gaza Strip area. The aim is to develop an innovation framework that can influence the municipalities' innovativeness.

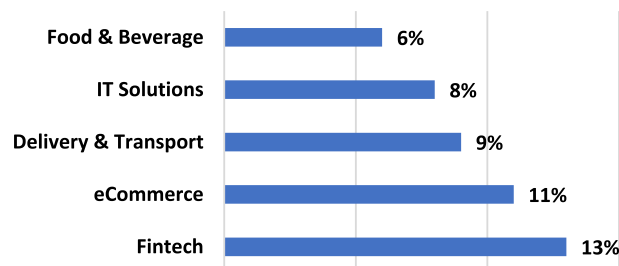
### Emerging technology trends

The narrative literature review identified common emerging technology trends that globally appeared on the list of top emerging technologies repeatedly during the past years, but every year a few technologies move off the list, and new ones take their place (Deloitte-a, 2020, CompTIA, 2020 and Cearley, 2020). This opened the debate whether these technologies are still qualified as “emerging” or not. These technologies are still very important and have a tremendous application, which means moving increasingly towards a mainstream application (Basole, 2018). CompTIA (2020) created a wealth of content that monitors current technology trends and helps shape technology's potential and implementation in the near future. According to the CompTIA Emerging Technology Community the top emerging technologies are IoT (Internet of Things), Big Data, Biometrics, Blockchain, AI (Artificial Intelligence), AR (Augmented Reality)/VR (Virtual Reality), Robotics, and Drones (CompTIA, 2020). Figure 1 shows that the fastest-growing emerging technology adoption has been IoT and Big Data followed by Biometrics. Drones and Robotics technologies were found to be in their early stages and need more exploration to become mainstream technologies. In general, the distribution of the emerging technologies by adoption mirrors the level of maturity of the organizations globally towards the implementation of these technologies.

As for the key emerging technology trends in the Middle East region, the ICT market will witness steady growth running through to 2024, Frost and Sullivan (2020) reported



**Fig. 1** Emerging technology adoption. Source: (CompTIA, 2020)

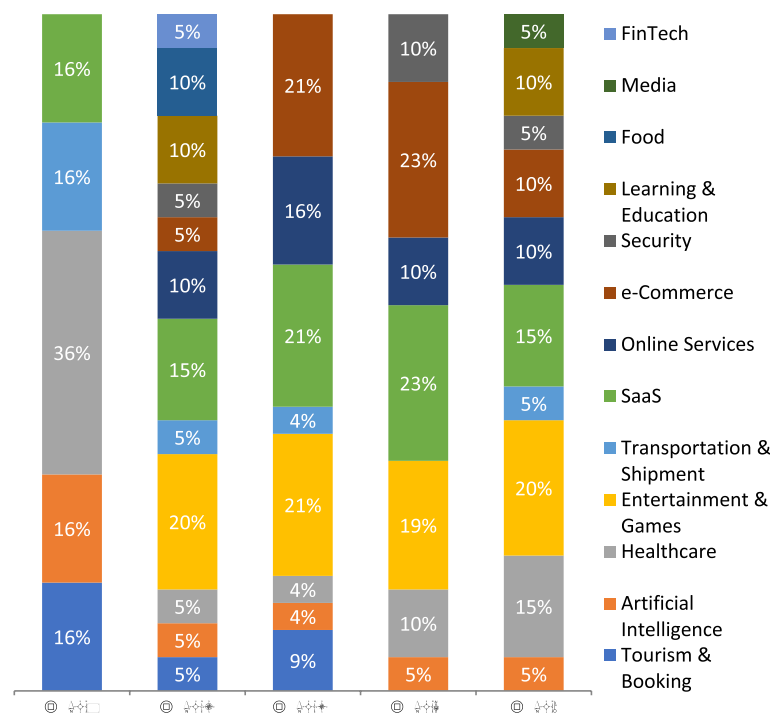


**Fig. 2** MENA's top 5 industries by number of deals in 2019. Source: reproduced from Magnitt, (2019)

that this growth will be driven primarily by government actions on digital transformation and business adoption of disruptive technologies, such as IoT (Internet of Things) and AI (Artificial Intelligence). The study also highlights Edge Computing, Industry 4.0, VR (Virtual Reality), Blockchain & DLT (Distributed Ledger Technology), Robotics, 3D Printing, 5G Networks, and AR (Augmented Reality). Deloitte-b (2020) added Big Data and FinTech (Financial Technologies). FinTech start-ups retained their top spot in 2019 as shown in Fig. 2 and accounted for 13% of all deals followed by eCommerce start-ups with a percentage of 11% while IT Solutions sectors are promising to be developed very fast (Magnitt, 2019).

AlAstal (2018) investigates the investment landscape in the Palestinian start-ups to highlight the emerging technologies and promising sectors. The results indicate that starting from the year 2014 investors show an increasing interest to invest in new sectors such as Online Services, eCommerce, Security, Learning & Education, Food, Media, and FinTech; see Fig. 3. The interest in eCommerce, SaaS (Software as a Service), AI (Artificial Intelligence), Entertainment & Games, Food, and Healthcare seems to be common across the years 2014–2017. FinTech and Media fields got a minor interest in the years 2014 and 2017, respectively, although the regional interest in these sectors is high. Entertainment & Games, SaaS, and eCommerce got the highest interest in comparison to the other fields during the last three years (AlAstal, 2018).

It is obviously clear that emerging technologies have become an important factor in starting, growing, and expanding businesses across all industries. The biggest question



**Fig. 3** Percent number of investments by sector by year. Source: (AIStal, 2018)

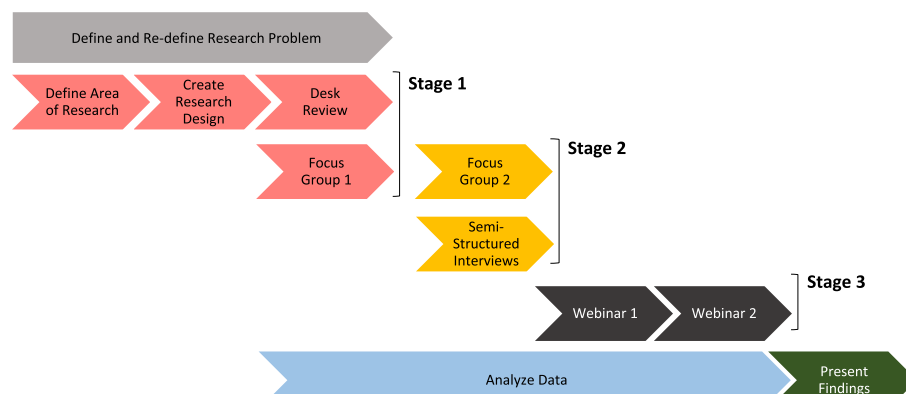
we have today is not whether or not businesses and municipalities need to transform the way they do business, but rather, what technologies are most likely to have the biggest impact on these respective stakeholders in Palestine.

## Methodology

The adoption of emerging technology applications in the Palestinian municipal sector is still in its infancy. Therefore, the development and diffusion of emerging technology innovation can be best interpreted by analyzing relevant stakeholders' conceptions. The research reported in this study is exploratory and uses qualitative data. A qualitative exploratory approach allows for researching dynamic, nuanced and multifaceted processes and exploring emerging themes (Cassell & Symon, 1994). Researchers of new technologies usually have an exploratory and applied emphasis (Barnes et al., 1992).

In this research, qualitative data were collected in three stages. The process can be seen visually in Fig. 4. During the first stage, the researcher defined the initial research area and outlined the research design processes and milestones. The cornerstone of this research was the desk review because it helps to formulate a more precise problem and determine the type of information required to identify the structure of the data that need to be collected, such as documents and papers generated by previous researchers. The desk review includes topics related to Technology-Enabled Municipal Innovation, Entrepreneurship and Municipal Collaboration, and Emerging Technology Trends. The researcher also conducted two focus groups comprising Information Technology professionals and subject matter experts to prioritize high-tech emerging technologies that may support the decision to launch technological start-ups. These focus groups were





**Fig. 4** Research process

		Highest Priority		Lowest Priority	
		Trend A	Trend B	Trend C	
Highest Priority	Tech 1	Innovative idea1			
	Tech 2		Innovative idea2	Innovative idea3	
Lowest Priority		Tech 3	Innovative idea4		

**Fig. 5** Tech & trend matrix. Source: (Articulated by the researcher, 2020)

useful for exploring and pre-testing general ideas, as well as for defining relevant emerging technology areas and themes, which are suitable for the context of Palestine.

In the second stage, another focus group conducted and aimed to examine the technological entrepreneurship opportunities by looking at the challenges of (22) municipalities in the Gaza Strip. Therefore, the attendees were mainly from Information Technology departments in the municipalities as well as representatives from the United Nations Development Program (UNDP). A data collection tool designed to explore how specific trends and technologies can impact the challenges at hand. The Tech & Trend Matrix is a sorting model, and a framework to assess how technology and trends are affecting the industry and relate to each other to trigger innovative ideas; see Fig. 5.

As to provide rich insights, semi-structured interviews were conducted with key information technology specialists from the municipal sector for exploring, identifying, and understanding viewpoints, attitudes, and influences. The semi-structured interviews allowed the researcher to explore the issues and topics posed in focus groups concerning drivers, challenges, and benefits of the implementation of new technological developments.

And in the third stage, two webinars were conducted with the cooperation of Business and Technology Incubator (BTI). The webinars produce rich cumulative and elaborative data by putting responses from individual participants into context. The dialogue among the webinar participants was free-flowing and versatile, which increased the possibility of new topics arising.

The first webinar focused on the development of an innovative digital economy in the light of the COVID19 pandemic. Four Information Technology experts from academic, public, and private sectors discussed the challenges for digital transformation in Palestine and highlighted possible cooperation opportunities between public and private



sectors to build a sustainable digital economy and mitigate the impact of the COVID19. The main objective of the second webinar was to highlight the main challenges that face Gaza Municipality—as a case study—and discussed current public–private partnership (PPP) practices and models at the Palestinian local level (municipalities) to provide a descriptive context and real knowledge to be used for further creation of the PPP concept and structure. The webinar explores the strengths and drawbacks of PPP practices at the local level and offers some suggestions for potential action. The participants were from the Municipality of Gaza, academic, private, and public organizations. All data collected during the study were gathered in a digital archive containing the transcripts, field notes, and documents.

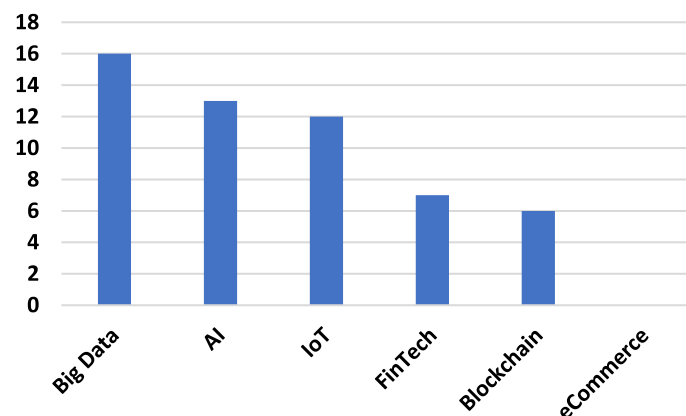
## Results and discussion

### Emerging technology themes suitable for the context of Palestine

The lack of a collective understanding of the emerging technologies in the Palestinian context may impact the uptake of learning about appropriate technologies in academic, private, and public areas. The approach used in this qualitative study was the focus groups by which groups of IT and subject matter experts examined the key problem and selected a set of best practices. The results revealed four emerging technologies and two important sectors as shown in Fig. 6. The experts agreed that it is important to focus on AI, Big Data, IoT, and Blockchain emerging technologies, but it is important to identify suitable challenges that can be addressed by these technologies. Adding to these technologies eCommerce and FinTech sectors will help to overcome many difficulties related to financial inclusion and how to support eCommerce to flourish in Palestine.

### Emerging technology opportunities in the municipal sector

Municipalities are the public service delivery engines in Palestine. Citizens expect municipalities to find ways to improve their public services and municipalities need to gear up to do so. This research examined how municipalities can use emerging technologies to improve public services by looking at the challenges of municipalities in the Gaza Strip.



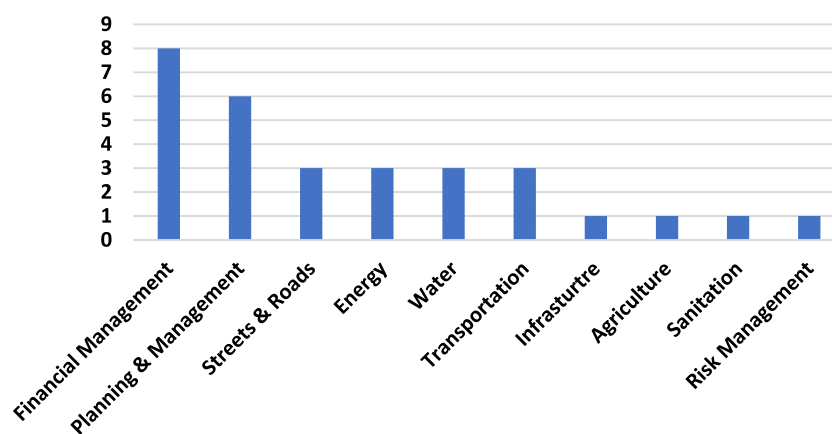
**Fig. 6** Emerging Technologies suitable for the context of Palestine classified according to its importance for developing integrated solutions. Source: (Articulated by the researcher, 2020)

Municipalities' representatives from Information Technology departments were being asked to list the main challenges facing the municipal work that can be solved through emerging technologies. The results revealed 30 challenges grouped into ten fields of interest as shown in Fig. 7.

Financial Management challenges got the highest interest with 8 challenges followed by 6 challenges for the Planning & Management field. Streets & roads, energy, water, and transportation fields got an equal interest of 3 challenges each leaving the remaining 4 challenges distributed between Infrastructure, Agriculture, Sanitation, and Risk Management fields.

Although the high interest in the financial management field by municipalities, Fin-Tech start-ups got the lowest investment opportunities as explained previously in Fig. 3. The interest in the planning & management field reflects the needs in this area for planning tools, which may rely heavily on the availability of healthy and clean data. The remaining fields need to be investigated to define properly integrated solutions as they may depend on one or more emerging technologies. Table 1 sheds more light on the initial evaluation of the integrated solutions required to overcome the challenges of the municipal sector. The municipalities' representatives did not show any interest in the eCommerce solutions although it can lower the cost of transactions for citizens by enabling them to interact with public services from their homes without having to queue at government and municipal offices.

According to Lindskog and Wennberg (2002), public sector eCommerce has played a major role in shaping national, regional, and international eCommerce standards worldwide. The researchers clarified that the establishment of an information society entails not only the simplification of information and transaction flows between governmental agencies (G2G) and the establishment of the appropriate infrastructure to provide online public services for people; Government to Citizen (G2C), but it also includes the establishment of an online service system for businesses (G2B). eCommerce has the potential to streamline existing functions and services in the public sector by reducing transaction costs or the cost of doing business (Reddick, 2009). The adoption of eCommerce methods has brought; and will continue to bring, efficiencies and financial savings as well as social benefits through greater and easier user



**Fig. 7** Fields of interest for the main challenges. Source: (Articulated by the researcher, 2020)

**Table 1** Municipalities challenges and the initial evaluation for emerging technologies Source: (Articulated by the researcher, 2020)

Challenge	Field of interest	Initial evaluation for emerging technologies					
		AI	Big Data	IoT	Blockchain	FinTech	eCommerce
High operational cost for machinery and cars	Financial Management					•	
Unified payment methods for public services	Financial Management					•	
Debt management	Financial Management					•	
Financial accounting management	Financial Management					•	
Contracts management	Financial Management				•		
Advanced solutions for billing systems	Financial Management					•	
Forecasting for currency exchange rates and raw material prices	Financial Management	•					
Tenders management	Financial Management				•	•	
Infrastructure management and planning for future projects	Infrastructure Management	•	•				
The need for an integrated solution to collect and manage data for all administration, financial and geographical information systems	Planning & Information Management	•				•	
Citizens data management to support decision-making and planning for new services	Planning & Information Management	•					
Attendance systems allow office and field employees to clock in and out electronically	Planning & Information Management			•			
Ownership and assets management	Planning & Information Management			•	•		
An integrated solution for human resources management	Planning & Information Management	•					
Data management tools to support the decision of future infrastructure services and city engineering	Planning & Information Management	•					
Improving communication channels with farmers to follow up planting and harvesting activities	Agriculture			•			
Streets and roads maintenance based on the usage of cars	Streets & Roads	•	•				
Follow up streets and roads that need maintenance	Streets & Roads	•	•	•			
Solving the problems of traffic congestions	Streets & Roads	•					

**Table 1** (continued)

Challenge	Field of interest	Initial evaluation for emerging technologies					
		AI	Big Data	IoT	Blockchain	FinTech	eCommerce
Sanitation management to ensure optimal processing	Sanitation	•					
Minimizing energy consumption for public utilities and controlling operational cost	Energy	•	•	•	•		
controlling and managing the lighting networks in the streets to minimize energy consumption	Energy	•		•			
Prioritize maintenance activities in the lighting networks	Energy	•		•			
The difficulties to control water wells and tanks to ensure equal distribution for citizens	Water	•	•	•	•		
Difficulties to control water valves due to data collection problems	Water		•				
Monitoring system for water network to avoid thefts and leakages	Water	•	•	•	•		
A live tracking system that will allow tracking with precision cars and field employees	Transportation		•	•			
Identification of machinery that needs support and maintenance	Transportation	•	•	•			
Follow up waste collection cars to define to the shortest path for data collection as to minimize costs	Transportation	•	•	•			
Building early warning systems for natural disasters	Risk Management	•	•				

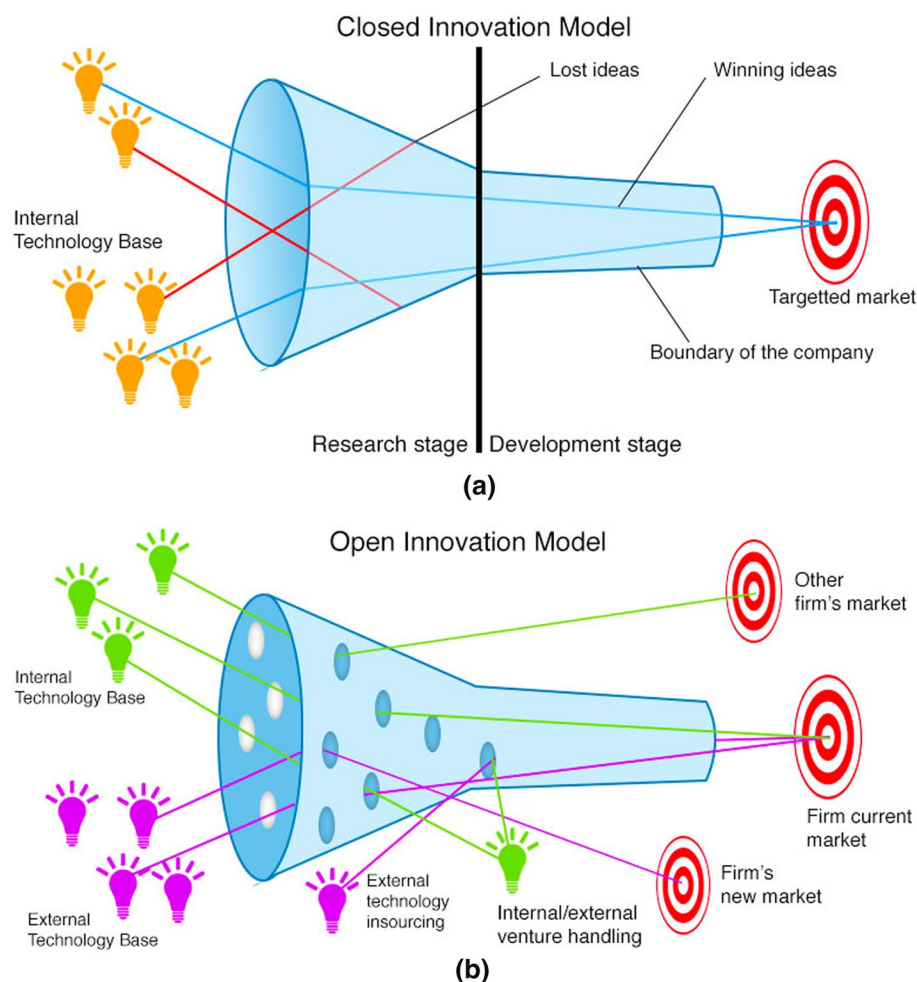
engagement and the provision of quicker and more effective information to service citizens. This means that municipalities in Palestine must constantly look forward to the next change.

### Entrepreneurship and municipal innovation

This part of the research discusses the technological entrepreneurship opportunities to develop an innovation framework that can influence the municipalities' innovativeness. Public sector organizations (such as municipalities) and private sector organizations (such as technological start-ups) both want to implement digital solutions to solve problems in cities, but currently seem to do so with neither clear aims for their work nor proper follow-up procedures.

The need for organizations to develop their creative ability has been an important motivator for exploring new ways to discover and leverage ideas that reach beyond organizational boundaries, one of these being the business model called Open Innovation (Chesbrough, 2003). The open innovation practices were said to have an impact on innovation and entrepreneurship due to the complementarities and uniqueness of the tools and expertise each organization offers (Ferraris et al., 2020). Chesbrough (2003) researched companies that have modified their innovation model and concluded that R&D is evolving into a new paradigm that requires a new form of the rationale for developing and profiting from innovation.

The R&D process relies on internal laboratories and resources in the conventional closed innovation model, while new ideas and innovations are researched and presented through internal resources; see Fig. 8a. Depending on the availability of resources, the capacities within municipalities vary significantly across their different forms (Rammal & Abuoun Hamad, 2008). Even though the Palestinian municipalities have made considerable progress in moving traditional services to online services, there is still a long way to reach seamless online services' systems due to budget and



**Fig. 8** **a** Ideas flow in the closed innovation model. **b** Internal and external ideas flow an open innovation model. Source: (Elmansy, 2015).

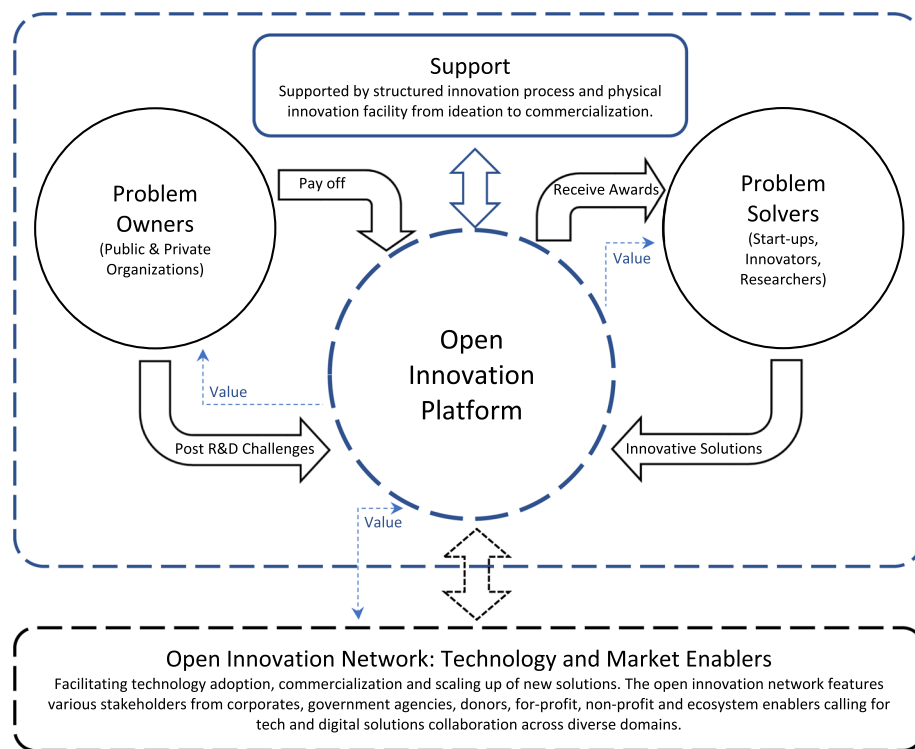
skills limitations (MOLG, 2018). Open innovation has emerged as a model for businesses to commercialize ideas/technologies both internally and externally, leveraging external and internal tools as shown in Fig. 8b (Elmansy, 2015). Projects can be launched from internal or external sources in an open innovation process and new technologies can be introduced at various stages. Projects can also be marketed in many ways, such as out-licensing or spin-off, besides traditional sales channels (Chesbrough, 2003).

Today, Open Innovation could be even more relevant in smart cities, where various private and public stakeholders work together to co-design and co-develop modern state-of-the-art products and services (Ojasalo & Tähtinen, 2016 and Tali, 2018). Nearly all municipality decision-making officials have heard about innovation and emerging technologies but there are no concrete action plans for implementation. At the same time, there is a growing understanding among municipality decision-makers that the use of emerging technologies is unavoidable in the near future. Technology development is depending on the availability of relevant skills and human resources (Cankar & Petkovšek, 2013).

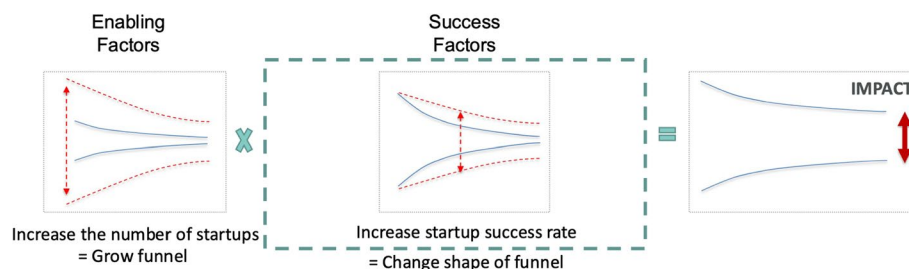
Open Innovation Platforms (OIP) provide an operating model compatible with public and private sector challenges for the reform of urban services and business growth activities (Raunio et al., 2016). The term "Innovation Platform" is described as an approach that systematically promotes innovation by external actors intending to create solutions to their problems and needs (Ojasalo, 2015). In this research, the municipalities are the problem owners who are looking for innovative solutions. The OIP is a virtual crowdsourcing platform that connects and matches real business challenges or digitalization opportunities of Problem Owners to Problem Solvers. The use of co-creation allows many more consumer-orientated services to be provided.

Such digitally enabled crowdsourcing for innovation is made effective through two mechanisms. First is the ability to recruit and leverage external collaborators (Baldwin & Von Hippel, 2011). Research has shown that distinctive ideas are manifest in the participation of more collaborators, not by relying on a small group of individuals with great range (Boudreau, 2012). Digital technologies provide channels of connectivity and platform scaffolding that enable spontaneous collaboration between those actors, i.e., problem owners (municipalities) and problem solvers (start-ups) as suggested in Fig. 9. Second, the Open Innovation Network (OIN) is a key success factor that will serve as the gateway for both problem owners and problem solvers to plug into the ecosystem for partnerships. The OIN features various stakeholders from corporates, government agencies, donors, for-profit, non-profit, and ecosystem enablers calling for tech and digital solutions collaboration across diverse domains. Start-ups thrive on relationships and the exchange of ideas. Therefore, establishing more relationships between founders and executives in the municipal sector will bring in fresh perspectives and more innovation, resulting in faster start-up growth and more vibrant ecosystems; see Fig. 10.

Eventually, there is a hope to scale this up to a regional platform. It is important for all parties involved to feel they receive a significant value in return for platform-based activities. By participating, platform users generate added value for each other. A successful platform creates a network effect that allows stakeholders to feel that they receive so much value for working with others that they return to the platform.



**Fig. 9** Suggested framework for open innovation platform supported by an open innovation network. Source: (Articulated by the researcher, 2020)



**Fig. 10** The new model of economic development using Open Innovation Platform. Source: (Articulated by the researcher, 2020)

## Conclusions and future research

Public sector innovators do not innovate in a vacuum, but in a structured organizational environment. Innovative municipal workers may not go very far if the organizational environment is not conducive to innovation. If the local municipalities' organization structure consists of people who understand and accept the importance of innovation and emerging technologies in modern government, then activities in this field are included in the plans of the municipality and will be supported. concerning staff capacity, there are problems in municipalities because they do not have the capacity to develop emerging technologies. The Gaza Strip municipalities need to provide start-ups and researchers with the appropriate conditions to use the



resources, knowledge, and ecosystems that the municipality possesses to create innovation that can help develop smart cities more competitively.

The open innovation platform-based tool described in this research can be seen to function as digital and physical interfaces that enable the participation of different start-ups and researchers in developing innovative technological solutions. These interfaces are a significant part of the structure of the innovativeness of the municipalities. The aim is to provide an overview of this area of platform-based development, and its fundamental elements and resources, so that we can tackle its challenges more effectively and comprehensively than before.

Financial technology (FinTech) start-ups got the lowest investment opportunities in Palestine during the past years although their high interest in the FinTech solutions field by different sectors including the municipal sector. Further research is required to provide a conceptual basis for enhancing FinTech applications in Palestine. It is recommended to review current regulations and assess how we can build an improved framework to attract and accommodate legal high-caliber FinTech entrepreneurs while providing good consumer and investor security to ensure financial stability.

This research also leads to some observations that might be of interest to future researchers for examining the application of e-Commerce in the public sector. The municipalities' representatives did not show any interest in the e-Commerce solutions; therefore, it is important to shed some light on the opportunities to exploit e-Commerce in the municipalities by gathering together the many lessons learned from the public sectors around the world to reiterate the successful applications in the municipal sector.

#### Abbreviations

AI	Artificial Intelligence
IoT	Internet of Things
FinTech	Financial technology
OI	Open innovation
OIP	Open innovation platform
OIN	Open innovation network
G2G	Government to Government
G2C	Government to customer
G2B	Government to business

#### Acknowledgements

The author would like to acknowledge Ms Azza Zeyad AlSahhar for her great support, useful discussions, and refining manuscript.

#### Author contributions

This manuscript was authored solely by the corresponding author. The author read and approved the final manuscript.

#### Author's information

Ashraf Y. AlAstal holds a master's degree in business administration from the Islamic University of Gaza and a B.Sc. degree in Computer Engineering from Applied Science University as well as multiple professional certificates in the fields of Project Management, Microsoft Systems Engineer, Blockchain Technology and Artificial Intelligence in Finance. Ashraf is having an international recognition and senior memberships from multiple organizations and initiatives; and representing Palestine as a national expert of UN-based digital contest; World Summit Awards. Moreover, he has participated as a judge for many national and international digital initiatives. He has been awarded multiple prizes for his outstanding performance. His achievements include also academic and research papers and books. Currently, he is working as a Technical/Business Development Advisor and as a Visiting Lecturer in the national universities. He is also a board member of the Palestinian Telecommunications Regulatory Authority.

#### Funding

This work has been developed through collaboration made possible by Business and Technology Incubator (BTI) and 10X Project. 10X Project "Fostering Palestinian Youth Entrepreneurship and Innovation via Enhancing Capacities of the Main Actors on the Palestinian Ecosystem to Promote Welfare and Competitiveness of the Palestinian Economy" which is funded by the Swiss Agency for Development and Cooperation (SDC) under the supervision of the United Nations Development Programme (UNDP).

### Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Declarations

#### Competing interests

The author declares no competing interests.

Received: 16 September 2021 Accepted: 6 April 2023

Published online: 17 April 2023

### References

- AlAstal, A. (2018). Bridging the gap: Assessing the funding landscape for Palestine's start-ups. *Entrepreneurship and Investment Conference, Islamic University of Gaza, Gaza, Palestine*.
- Baldwin, C., & Von Hippel, E. (2011). Modeling a paradigm shift: From producer innovation to user and open collaborative innovation. *Organization Science*, 22(6), 1399–1417.
- Barnes, D., Buckland, B., & Brancheau, J. (1992). Methodological issues in emerging technologies research: Experiences and recommendations. *Proceedings of the Twenty-Fifth Hawaii International Conference on System Sciences*, 4, 325–336.
- Basole, C. (2018). Visualizing Ecosystems of Hype. *Proceedings of the 51<sup>st</sup> Hawaii International Conference on System Sciences*. <https://doi.org/10.24251/HICSS.2018.621>
- Boudreau, K. (2012). Let a thousand flowers bloom? An early look at large numbers of software app developers and patterns of innovation. *Organization Science*, 23(5), 1409–1427.
- Cankar, S., & Petkovšek, V. (2013). Private and public sector innovation and the importance of cross-sector collaboration. *The Journal of Applied Business Research*, 29(6), 1597–1606.
- Cassell, C., & Symon, G. (1994). *Qualitative methods in organisational research*. Sage Publications.
- Cearley, D. (2020). The top 10 strategic technology trends for 2020. *Complimentary full research, Gartner research*. Retrieved (20/04/2021) from <http://www.prospectiveyestrategia.cl/pdf/top-tech-trends-2020-ebook.pdf>
- Chesbrough, H. (2003). The era of open innovation. *MIT Sloan Management Review*. Retrieved (20/04/2021) from <https://sloanreview.mit.edu/article/the-era-of-open-innovation>
- CompTIA (2020). International trends in technology and workforce. *The Computing Technology Industry Association, CompTIA*. Retrieved (01/04/2021) from <https://connect.comptia.org/content/research/international-trends-workforce-cybersecurity-emerging-tech>
- Deloitte-a (2020). Tech Trends 2020. *Emerging Technology research, Deloitte Insights*. Retrieved (20/04/2021) from [https://www2.deloitte.com/content/dam/Deloitte/za/Documents/technology/za\\_DL\\_Tech\\_Trends\\_2020\\_Africa\(006\).pdf](https://www2.deloitte.com/content/dam/Deloitte/za/Documents/technology/za_DL_Tech_Trends_2020_Africa(006).pdf)
- Deloitte-b (2020). Evolving technology trends: Is your bank ready for tomorrow? *Emerging Technology research, Deloitte Middle East*. Retrieved (20/04/2021) from [https://www2.deloitte.com/content/dam/Deloitte/xs/Documents/technology/me\\_evolving-tech-trends.pdf](https://www2.deloitte.com/content/dam/Deloitte/xs/Documents/technology/me_evolving-tech-trends.pdf)
- Eggers, W., & Bellman, J. (2015). The journey to government's digital transformation. *A Deloitte Digital global survey, Deloitte University Press*. Retrieved (01/04/2021) from [https://www2.deloitte.com/content/dam/insights/us/articles/digital-transformation-in-government/DUP\\_1081\\_Journey-to-govt-digital-future\\_MASTER.pdf](https://www2.deloitte.com/content/dam/insights/us/articles/digital-transformation-in-government/DUP_1081_Journey-to-govt-digital-future_MASTER.pdf)
- Elmasy, R. (2015). Implementing open innovation to drive creativity inside organizations. *Research report, Designorate*. Retrieved (20/03/2021) from [https://www.designorate.com/wp-content/uploads/2015/03/Designorate\\_Report\\_Open\\_Innovation.pdf](https://www.designorate.com/wp-content/uploads/2015/03/Designorate_Report_Open_Innovation.pdf)
- Ferraris, A., Santoro, G., & Claudia Pellicelli, A. (2020). Openness of public governments in smart cities: Removing the barriers for innovation and entrepreneurship. *International Entrepreneurship and Management Journal*, 16, 1259–1280.
- Frost & Sullivan (2020). ICT market in the middle east, forecast to 2024. *Global Information & Communication Technologies Research Team*. Retrieved (15/04/2021) from <https://store.frost.com/ict-market-in-the-middle-east-forecast-to-2024.html>
- IoD (2018). Digital government and the productivity puzzle: The case for partnership between the public and private sectors. *Institute of Directors (IoD) Policy Report*. Retrieved (01/04/2021) from <https://www.iod.com/Portals/0/PDFs/Campaigns%20and%20Reports/Digital%20and%20Technology/Digital-govt-productivity-puzzle.pdf?ver=2017-12-21-114748-427>
- Jaffal, A. (2018). *Assessment of innovative approaches in inclusive service delivery and local governance in the OPT*. Palestine Economic Policy Research Institute MAS.
- Jayasena, N., Mallawaarachchi, H., & Waidyasekara, K. (2019). A critical review on the drivers and barriers for enabling smart cities. *Proceedings of the International Conference on Industrial Engineering and Operations Management, Bangkok, Thailand*.
- Kay, R., & Goldspink, C. (2013). Public versus private sector innovation—a case of apples and oranges. *The Australian Institute of Company Directors Keeping Good Companies*, 65(1), 17–23.
- Kay, R., & Goldspink, C. (2016). Public sector innovation: Why it's different. *The Australian Institute of Company Directors*. Retrieved (01/04/2021) from [https://aicd.companydirectors.com.au/~media/cd2/resources/advocacy/governance-leadership-centre/pdf/05493-1-pol-glc-public-sector-innovation-research-paper-a4-may16\\_web.ashx](https://aicd.companydirectors.com.au/~media/cd2/resources/advocacy/governance-leadership-centre/pdf/05493-1-pol-glc-public-sector-innovation-research-paper-a4-may16_web.ashx)
- Karakas, C. (2020). Public sector innovation: Concepts, trends and best practices. *European Parliamentary Research Service*. Retrieved (15/04/2021) from [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651954/EPRS\\_BRI\(2020\)651954\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651954/EPRS_BRI(2020)651954_EN.pdf)

- Kusumasari, B., Pramusinto, A., Dwi Santoso, A., & Audori Fathin, C. (2019). What shapes public sector innovation? *Public Policy Administration Research Journal*, 18(4), 430–446.
- Lindskog, H. & Wennberg, H. (2002). Learning from "Big Brother": Public Sector e-commerce as a role model for Swedish industry. Accessed through Semantic Scholar research tool. Retrieved (15/04/2023) from [http://www.heldag.com/articles/Microsoft\\_Word\\_-\\_lindskog-wennberg.pdf](http://www.heldag.com/articles/Microsoft_Word_-_lindskog-wennberg.pdf)
- Magnitt (2019). 2019 Mena venture investment summary. *A start-up research firm that connects investors, mentors, and emerging companies in the Middle East*. Retrieved (15/04/2023) from [https://d2p9i44hnkrmkx.cloudfront.net/files/research-files/712020/8528773838751-2019%20MENA%20Venture%20Investment%20Summary.pdf?utm\\_source=web\\_download&utm\\_medium=email&utm\\_campaign=download](https://d2p9i44hnkrmkx.cloudfront.net/files/research-files/712020/8528773838751-2019%20MENA%20Venture%20Investment%20Summary.pdf?utm_source=web_download&utm_medium=email&utm_campaign=download)
- Mazurkiewicz, A. (2018). *Barriers of technological innovation development and implementation encountered by R&D organizations*. Institute for Sustainable Technologies, National Research Institute, Radom, Poland.
- MDLF. (2009). *Public private partnership in the municipalities*. The Municipal Development and Lending Fund, Palestine.
- MDLF. (2019). *Annual report 2019*. The Municipal Development and Lending Fund Palestine.
- MOLG. (2018). *E-municipality strategic framework 2019–2023*. Ministry of Local Government, Palestine.
- Morar, R. (2018). *Overview of the digital and innovation ecosystem in Palestine*. Palestine Economic Policy Research Institute MAS.
- Mulgan, G., and Albury, D. (2003). Innovation In the Public Sector. *Cabinet Office Strategy Unit, United Kingdom Cabinet Office*. Retrieved (01/04/2021) from [http://www.sba.oakland.edu/faculty/mathieson/mis524/resources/readings/innovation/innovation\\_in\\_the\\_public\\_sector.pdf](http://www.sba.oakland.edu/faculty/mathieson/mis524/resources/readings/innovation/innovation_in_the_public_sector.pdf)
- Ojasalo, J. (2015). Open innovation platform in a smart city: Empirical results. *The Journal of American Business Review Cambridge*, 4(1), 195–202.
- Ojasalo, J., & Tähtinen, L. (2016). Integrating open innovation platforms in public sector decision making: empirical results from smart city research. *Technology Innovation Management Review*, 6(12), 38–48.
- Orton-Jones, C. (2018). *Public sector technology: government must be smarter buying tech* (p. 537). An Independent Publication By RACONTEUR.
- PITA. (2018). *EXPOTECH final technical report*. Palestine Technology Week Palestinian Information Technology Association of Companies.
- Przebylłowicz, E., Alexandra Cunha, M., & de Souza Meirelles, F. (2018). The use of information and communication technology to characterize municipalities: Who they are and what they need to develop e-government and smart city initiatives. *Revista De Administracao Publica*. <https://doi.org/10.1590/0034-7612170582>
- Rammal, I. & Abuoun Hamad, S. (2008). Planning Capacities within the Palestinian Municipalities. *1st International Conference on Urban Planning in Palestine: Current Challenges & Future Prospects*, Al Najah University, Palestine.
- Raunio, M., Nordling, N., Ketola, T., P. Saarinen, J. & Heinikangas, A. (2016). Open innovation platforms: an approach to city development. (1. edition, version 1.5.), [Council of Tampere Region]. <https://jyu.finna.fi/Record/jykdok.1719567?lng=en-gb>
- Reddick, C. (2009). *Public sector E-commerce contemporary applications*. IGI Global Publisher of Timely Knowledge. 10.4018/978-1-60566-096-7.ch008.
- Sawatzky, A., Slemon, K. & Grills, T-A. (2017). "Exploring Municipal Innovation For The 2017 Municipal Innovators Community Conference". *Guelph, ON: Community Engaged Scholarship Institute*. Retrieved (15/04/2021) from <https://atrium.lib.uoguelph.ca/xmlui/handle/10214/8902>
- Serrat, O. (2017). Innovation in the Public Sector. In: Knowledge Solutions. Springer, Singapore. [https://doi.org/10.1007/978-981-10-0983-9\\_59](https://doi.org/10.1007/978-981-10-0983-9_59)
- Shahwan, U., & Soudah, R. (2005). Public-private partnership: A strategy for economic development in Palestine. *Bethlehem University Journal*, 24(2005), 9–30.
- Shearmur, R., & Poirier, V. (2016). Exploring municipal innovation: Technological and original innovation in municipalities. *Institut National de la Recherche Scientifique Centre Urbanisation Culture Société Montreal*. <https://doi.org/10.13140/RG.2.1.1882.9847>
- Taha, S., Jamal, J., Ahulibdah, M., Khewis, M., Ismaeel, H. & Abu Salem, S. (2020). Mapping of Innovation Hubs in Palestine. *The Belgian Development Agency (Enable)*. Retrieved (15/04/2021) from [https://www.enable.be/sites/default/files/tenders/final\\_report\\_-\\_mapping\\_study\\_of\\_innovation\\_hubs\\_part\\_1.pdf](https://www.enable.be/sites/default/files/tenders/final_report_-_mapping_study_of_innovation_hubs_part_1.pdf)
- Tali, G. (2018). Start-up and open innovation. *Master thesis, New Jersey Institute of Technology. Theses. 1579*. Retrieved (01/04/2021) from <https://digitalcommons.njit.edu/theses/1579>
- UNECE. (2017). Innovation in the public sector. *United Nations publication issued by the Economic Commission for Europe*. Retrieved (15/04/2021) from [https://unece.org/DAM/ceci/publications/Innovation\\_in\\_the\\_Public\\_Sector/Public\\_Sector\\_Innovation\\_for\\_web.pdf](https://unece.org/DAM/ceci/publications/Innovation_in_the_Public_Sector/Public_Sector_Innovation_for_web.pdf)
- Waghmare, V., Patil, J., & Khandekar, S. (2015). Application of GIS in planning to facilitate infrastructure. *International Journal of Advance Research in Computer Science and Management Studies*, 3, 356–362.

## Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.