ÇANAKKALE'S ROADMAP TO BECOMING A SMART CITY

TABLE OF CONTENTS

FOREWORD

I am delighted and thrilled to present this report on the "Çanakkale On My Mind" project which I sincerely believe serves our roots and lands where Kale Group was born.

As Kale Group we have always strived to be part of every project that does justice to Çanakkale's potential and is carried out in keeping with the city's spirit. The economic and social investments we have made in Çanakkale, even when the smart city concept had not yet been coined, is no secret. To take this one step further, teaming up with the Turkish Informatics Foundation (TBV) headed by Faruk Eczacıbaşı, who continues to deliver invaluable work for our country's transformation into an information society, and with Novusens providing consultancy as an expert organisation with extensive experience in smart cities, we launched the Çanakkale On My Mind project to step up Çanakkale's transformation into a smart city and contribute to improving the quality of life. Having reached an important phase, we are presenting a vision to Çanakkale for a smart city transformation. Kale Group is a community that is design-oriented, grounded in innovation, and invests in cutting-edge technologies. However, we are not a technology company. And that is why we named our project Çanakkale On My Mind and not Smart City Çanakkale. This was an intentional choice. Because it's people that are at the very heart of our project. And that's what's going to make all the difference. Where the ultimate aim is the happiness and welfare of people and technology is a means to an end, we know that such projects are bound to succeed and will last for many years.

Zeynep BODUR OKYAY
CHAIRMAN & CEO, KALE GROUP

This is precisely why we are embarking on this transformation journey together with all of the relevant organisations and all local stakeholders in an inclusive manner building on collective wisdom and constructive partnership. By employing a strategic plan through this project, we want to support the prioritisation and implementation of services and practices that touch people and improve life for citizens. Furthermore, a common vision, good governance, financial productivity and sustainability are key to making sure we succeed on this journey.

Along these lines, we are more than ready to provide every support it takes to spearhead, facilitate and pave the way for global partnerships for all initiatives that contribute to the city. With realistic expectations and a strategic road map, we want to plan and execute the next steps together with our valuable project partners.

Today, a new window of opportunity opens before us. Thanks to the Çanakkale 1915 Bridge, this city will become a more accessible centre of attraction. It is crucial that this transformation takes place in a way that improves the quality of life in the city, following collective wisdom and good governance practices.

60 years back from today our founder and honorary chairman Ibrahim Bodur started manufacturing ceramics in Çan, making Çanakkale the pioneer of industrialisation across Anatolia. Today, Çanakkale can set an example for our cities to transform into smart cities and people of Anatolia into an information society for sustainable development and inclusive welfare.

Those public organisations, local governments, universities and NGOs that have "Çanakkale On Their Mind" and channel their resources and energy to achieve this objective will play a pivotal role in this transformation. Including citizens in this process and keeping the lines of communication and dialogue open are also critical elements to this end.

We know very well that change starts locally. Projects that are locally driven and that include solutions taking into account the city's dynamics create a lasting impact. Our goal is to make Çanakkale an example to other cities in Turkey and, in fact, make Çanakkale one of the success stories in the world. There is no reason that Çanakkale should not be cited in international literature as an innovation model in the near future?

I would like to take this opportunity to once again thank everyone who has worked for this project and contributed to it. I hope this will be a long-lasting journey.

Out of the 81 cities in our country, one of the places that everyone can immediately 'locate' is Çanakkale. Everyone knows where Çanakkale is. Because Çanakkale is a city that has witnessed utmost strategic, incredibly important, tragic, dramatic and life-or-death turning points in history. Today, it is a route of trade and peace open to international maritime traffic. When the bridge that connects both sides of the Straits is completed it will also serve as a key passage linking Europe and Asia by road. These external factors make Çanakkale all the more important today. Modernising the city's internal operations in line with these external factors will increase Çanakkale's economic importance exponentially. This is only possible by delivering internal operations in Çanakkale that live up to the definition of a 'smart city'. Çanakkale ranks 14th in Turkey based on GDP per capita and 5th according to human capital and social capital indices. Its physical infrastructure has secured Çanakkale 10th place, creative capital 14th place, and labour market and financial depth 17th place. We expect that smart city practices implemented through smart and tactful strategies will further improve these rankings. Because by a smart city, we mean a city that invests in information and communication technologies to use its limited resources more effectively and efficiently, generates savings as a result of those investments, improves its services and the quality of life thanks to those savings, reduces its carbon footprint, respects the environment and natural resources and does all these in an innovative and sustainable manner.

Faruk ECZACIBAŞI
CHAIRMAN, TURKISH INFORMATICS FOUNDATION

This is how Çanakkale could be. It can transform into a smart city that uses data collected from smart measurement devices for innovative real-time and future decision-making processes.

With a view to achieving this goal, we are embarking on a journey together with the local government, people, civil society, private sector and universities in Çanakkale to transform this one-of-a-kind city into a smart city through collective wisdom.

I believe that the solutions we offer here for 'smart urbanisation' will set an example for other cities in Turkey.

Our project is called "Çanakkale On My Mind".

We are going to share what's on our mind with everyone to make Çanakkale leap forward.

There is no city that has become smart only by municipal efforts. And no city can become smart without picking the brains of its citizens that make up the city. That's why, I am confident that the people of Çanakkale will support us with their wisdom and ideas on this journey that we have embarked on. Because now is the time of 'collective wisdom'.

The leadership of a successful Çanakkale-based industrial organisation is strategically important for Çanakkale's smart city transformation. We, as the Turkish Informatics Foundation, are honoured to support Kale Group.

Busy manufacturing and exporting cutting-edge technologies on the one hand, Kale Group on the other hand is striving to ensure that the city where it was born, bred and industrialised gets its share of cutting-edge technologies. If only all of our industrialists could think and work strategically to transform the cities, where they were born in and owe their presence to, into smart cities just like Kale Group. It goes without saying that there are brilliant examples in Turkey, however too few. Transforming all of our 81 cities into smart ones should be on the agenda of all industry and business people in these cities.

I would like to wholeheartedly congratulate Zeynep Bodur Okyay on behalf of Kale Group for this excellent initiative. I salute it as a bold and civilised step on this narrow and long road that we must take to transform Turkey into an information society. I would also like to thank the Novusens Smart City Institute for its contributions to the project's field studies and reporting.

And, last but not least, a huge thank you to the Çanakkale Municipality, Governor's Office and all public and private organisations that have supported Çanakkale on this journey.

Here's hoping all the best on this journey to transform Çanakkale into a smart city.

INTRODUCTION

According the United Nation's studies, today more than half of the world's population, surpassing 7.5 billion, live in urban areas. Projections show that this is expected to increase to 70% by 2050. The urban areas where half of the world's population live is expected double in just 15 years from now. According to the 2017 World Population Prospects report, the world's population is expected to increase to 8.6 billion in 2030, 9.8 billion in 2050, and 11.2 billion in 2100.

The World Bank's data reveals that around 72% of Turkey's population, reaching 80 million, live in urban areas and predictions show that this rate will rise to 80% in 2030 with a population surging to approximately 88 million.

According to the Turkish Statistical Institute (TUIK), Çanakkale's population of 519,793 in 2017 is expected to grow by an average 0.74% per year, exceeding 535,000 in 2023. With a population density of 52 people per square kilometre Çanakkale is one of the top three cities with the lowest share of children and ranks among the top five cities with the highest median age. Çanakkale was the second top city with the highest median age in 2012. It is expected to fall to 14th place in 2023.

This staggering uptick in urban populations facing the world and Turkey makes it imperative to use limited resources efficiently starting immediately.

A city is called a smart city when it invests in information and communication technologies to use limited resources more effectively and efficiently, generates savings as a result of such investments, uses these savings to increase the quality of life and its services, minimises it carbon footprint on the environment, respects nature and natural resources, and does all these in a sustainable manner.

The Çanakkale On My Mind project aims to define the steps needed to transform Çanakkale, situated in the heart of the region dubbed the 'golden circle' along the Istanbul-Izmir axis, into a smart city and design a road map together with all stakeholders. Born in Çanakkale's district Çan and celebrating its 60th anniversary this year, Kale Group joined forces with the Turkish Informatics Foundation (TBV) and Novusens Smart City Institute and launched the Çanakkale On My Mind project on the 1st of February 2017.

OBJECTIVE AND APPROACH

With a view to contributing to Çanakkale's transformation into a smart city, the first phase of the Çanakkale On My Mind project consists of analysing the current situation, identifying a vision and then designing a Smart City Road Map for the next steps. The project ultimately aims to enhance Çanakkale's competitiveness, both nationally and globally, by contributing to Çanakkale's liveability and sustainability through technology.

Led by Novusens, the field team assembled for the Çanakkale On My Mind project initially carried out a comprehensive literature review. This review was followed by a series of field visits to gather insights into the current situation in Çanakkale and a survey for the various organisations across the city. In light of the findings, a seminar on smart cities and two separate workshops for collective thinking took place – one for organisations and the other for youth associations. The project team then assessed the findings of these activities in light of the practices across the world and presented a smart city road map and proposals tailored to Çanakkale.

The rest of this document provides an overview of the first phase of the Çanakkale On My Mind project and defines the concept of smart city transformation. The following sections probe into the current situation in Çanakkale vis-à-vis smart city applications, priorities for smart city components, and key challenges and critical success factors to introduce proven practices. The proposed visions and solutions and road map are provided in the final section. This document is an executive summary. The full version is available on the websites of the project stakeholders.

The first phase of the Çanakkale On My Mind project consists of five sections:

I. Literature Review

The current vision and strategy documents, activity reports, investment plans of various local organisations as well as demographic reports etc. created by agencies such as the Turkish Statistical Institute (TUIK) were reviewed thoroughly and detailed information was gathered by visiting the relevant organisations and experts. In addition, literature on example smart cities similar to Çanakkale were also reviewed (Annex 2).

II. Field Visits in Çanakkale

Over the course of the project, meet-and-greet events and analysis meetings were held with the relevant public and private organisations, universities and NGOs. Furthermore, one-on-one meetings were conducted with volunteers devoted to Çanakkale who wished to contribute to the project. The public and private sectors, universities, NGOs, young people and volunteers were involved in this project. The Stakeholder Map below provides the participating organisations (Figure 1):

Figure 1. Çanakkale On My Mind Project Stakeholder Map

III. Çanakkale Smart City Survey

As part of the study, a Smart City Survey aimed at the participating organisations was conducted. A total of 40 respondents from 17 organisations in Çanakkale took part in the survey.

IV. Çanakkale Smart City Seminar

To be on the same page, a comprehensive Smart City Seminar was organised to look into the concept of smart cities and its components and explain the Smart City Transformation Model, Çanakkale On My Mind project and best smart city practices with videos. The Governor of Çanakkale, Mayor of Çanakkale, Mayor of Kepez, officials and representatives from relevant public organisations, private organisations, NGOs and the university attended the seminar.

V. Çanakkale Collective Thinking Workshop

A workshop for collective thinking was held with the participation of relevant public and private organisations, universities and NGOs in Çanakkale. During the workshop, a summary of the Smart City Seminar was presented and current challenges and needs from a smart city viewpoint were identified. The participants suggested solutions and worked collectively on the proposed Çanakkale Smart City Visions.

The same workshop was held at a later date for youth associations in Çanakkale. Following the Smart City Seminar, the same method was employed to identify current challenges and needs, come up with solutions and propose smart city visions from the perspective of young people.

" Launched in anticipation of high-level participation for the first time in Turkey and owned by all stakeholders with equal vim and vigour, the outputs of the smart city transformation project were made public at a press conference in Çanakkale on 31 May 2017 attended by a large number of people, including Orhan Tavlı, Governor of Çanakkale, Ülgür Gökhan, Mayor of Çanakkale, Zeynep Bodur Okyay, Chairman & CEO, Kale Group, Faruk Eczacıbaşı, Chairman, Turkish Informatics Foundation, and Çanakkale's key opinion leaders. The Novusens Smart City Institute presented the results of the project during the meeting. "

SMART CITY TRANSFORMATION

Cities are hubs of creativity and innovation. However, factors like rising populations, rapid urbanisation and climate change are putting increased pressure on cities, especially for transportation, environment and healthcare, creating more challenges. Cities are encouraged to capitalise on technology as a means to overcome these challenges and turn them into opportunities.

In most cases, to overcome urban challenges, social and organisational changes take centre stage instead of easy-to-apply technology solutions. If cities are to become smart, changing the behaviours of their inhabitants will play a crucial role. The role of technology can be defined as a facilitator for such behavioural changes, for instance, by reducing the demand for energy or changing travel habits (see: Open University, FutureLearn).

On the other hand, today's smart technologies have matured enough to allow cities of all scales to finance and use smart applications. For example, new cloud solutions can offer even the smallest cities very high processing power and storage capacity.

It is useful to note that certain concepts can come in handy when talking about smart city transformation. Firstly, there are rather diverse definitions of what it means to be a smart city, some of which are provided below.

According to the most widely accepted definition, cities are centres of economic and social growth. Smart cities refer to the effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens (British Standards Institute, 2014).

According to another definition, "a smart city uses information and communications technology to enhance its liveability, workability and sustainability" (Smart Cities Council, 2015).

The European Union defines a smart city as "a place where the traditional networks and services are made more efficient with the use of digital and telecommunication technologies, for the benefit of its inhabitants and businesses."

Another key characteristic of a smart city is the maturity level. According to the European Union's methodology, the maturity level of a smart city is identified using the following categorisation, where cities that do not attain maturity level one do not qualify as smart (see: Mapping Smart Cities in the EU, 2014):

1	2	3	4
Maturity Level	**Maturity Level**	**Maturity Level**	**Maturity Level**
A Smart City Strategy or Policy only	In addition to level 1, a Project Plan or Project Vision, but no piloting or implementation	In addition to level 2, pilot testing of Smart City initiatives	A Smart City with at least one fully launched or implemented Smart City initiative

SMART CITY APPLICATIONS IN ÇANAKKALE

The smart city applications identified in Çanakkale through meetings, surveys and online reviews as part of the study are provided below.

Some features of these applications are:

Collecting data about a given area through systems/smart devices/sensors used to measure and monitor urban conditions.

Transmitting the data collected to other systems/devices/centres via wired or wireless networks.

Using urban data about a given area for real time decision-making or future projections for the benefit of inhabitants. For example:

✔ Sharing real-time data with officials/citizens in a user friendly manner

✔ Balancing load by data optimization

✔ Making future projections

SMART BUS STOPS

This system informs commuters waiting at a bus stop about bus arrival times and the number of stops in between. A total of 30 smart bus stop screens provide three sets of information: bus route, name of the final stop and number of stops left. In addition, the smart bus stop screens contain symbols indicating which of the incoming buses are accessible. The smart bus stop screens also offer voice guides for visually impaired citizens.

SMART JUNCTION

The Smart Junction system, used at the Cuma Pazarı (marketplace) junction in Çanakkale, regulates traffic by switching traffic lights to green or red based on vehicle density without any fixed-time dependency. This system is considered to be one of the steps towards regulating the rather congested traffic, particularly in the mornings and evenings.

The built-in smart cameras in the Smart Junction System located at junctions with traffic lights identify the number of vehicles in each direction and manage the traffic lights solely depending on the vehicle volume. This minimises the average waiting time for vehicles at the junction, saving on time and fuel while reducing carbon footprint and pollution.

ÇANAKKALE CITY CARD

Kentkart (City Card) is a card used across Çanakkale which consists of Electronic Fare Collection with Contactless Smart Cards, Vehicle Monitoring, Smart Stop Passenger Information, Mobile Passenger Information and In-Vehicle Camera Systems.

Kentkart payments can be made using NFC compatible mobile phones and credit cards and can also be topped up online. The system was created in 2006 to generate various reports to support decision-making and analytics through real-time monitoring of public transport vehicles and ultimately facilitate the lives of citizens.

ÇABIS

The Çanakkale Municipality Smart Bicycle Rental System (ÇABIS) was launched with a view to encourage city dwellers to use bikes and solve the traffic and parking problems in the city. ÇABIS covers a 15-kilometres bike route in the city and has Smart Bicycle Rental Terminals in a total of five stations with 35 bicycles ad 42 parking spots available. The system accepts ÇABIS smart cards or credit cards. Information such as the distance travelled and calories burned can be sent to the user's mobile phone. (For more information: https://cabis.canakkale.bel.tr/)

E-MUNICIPALITY SERVICES

The e-municipality system available since 2008 for quick, reliable and easy access to municipal services enables citizens to obtain information and make online inquiries about debts and accruals for various municipal services, make payments, submit requests and complaints and follow these up. (For more information: https://ebelediye. canakkale.-bel.tr/web/guest/2)

CITY INFORMATION SYSTEM

The Smart City Information System introduced to shorten service times and economise on resources aims to deliver services more efficiently through the 360-degree city map, which provides information related to civil registries, real estate, zoning, proprietorship, infrastructure, utilities, and subscriptions through online integration with the relevant organisations. (For more information: http://webgis.canakkale.bel.tr/keos/)

ÇANAKKALE MUNICIPALITY CALL CENTRE

Building on computer technologies from a people-oriented viewpoint, this system receives and records requests and complaints placed by citizens and, if necessary, converts them into job orders. The system is accessible through the call centre (444 1717), social media ('WhatsApp') or the 'Mobile Democracy' app. (For more information: http://www.canak-kale.bel.tr/icerik/261/cagri-merkezi/)

ÇANAKKALE MUNICIPALITY GREEN BUILDING AND CULTURAL CENTRE

The building that will generate its energy from natural resources such as the sun, wind and earth and bring all municipal units under one roof is expected to open in 2018. The semi-conductive photovoltaic panels installed on the roof windows aim to generate electricity for the building while enabling sunlight to enter in a controlled manner. (For more information: http://www.canakkale.bel.tr/assets/content/yesil-yerel-yonetim-ve-kultur-merkezi-binasi-c7bb8.pdf)

ÇANAKKALE MUNICIPALITY ADVANCED BIOLOGICAL WASTEWATER TREATMENT PLANT

Commissioned by the Çanakkale Municipality with support from the Provincial Bank (Iller Bankası), the biological wastewater treatment plant consists of the physical treatment, advanced biological treatment and sludge dewatering units and features ultraviolet disinfection. Thanks to this plant, treated water will be used for agricultural irrigation in the future.
(For more information: http://www.canakkale.bel.tr/icerik/2860/canakkale-belediyesi-ileri-biyolojik-atiksu-aritma-tesisi-hizmete-girdi8230/)

UEDAŞ SCADA SYSTEM

Introduced in Çanakkale in 2016 by UEDAŞ (Uludağ Electricity Distribution Co. Inc.), the SCADA system allows energy distribution systems to be measured, monitored and controlled remotely 24/7 as well as immediately intervene remotely in case of a breakdown.

SMART CITY APPLICATION PRIORITIES IN ÇANAKKALE

This section attempts to identify Çanakkale's smart city priorities for the future in light of the collective thinking workshops, surveys and one-on-one meetings.

To this end, out of the available definitions for smart city components, the European Union's smart city characteristics were used (Figure 2).
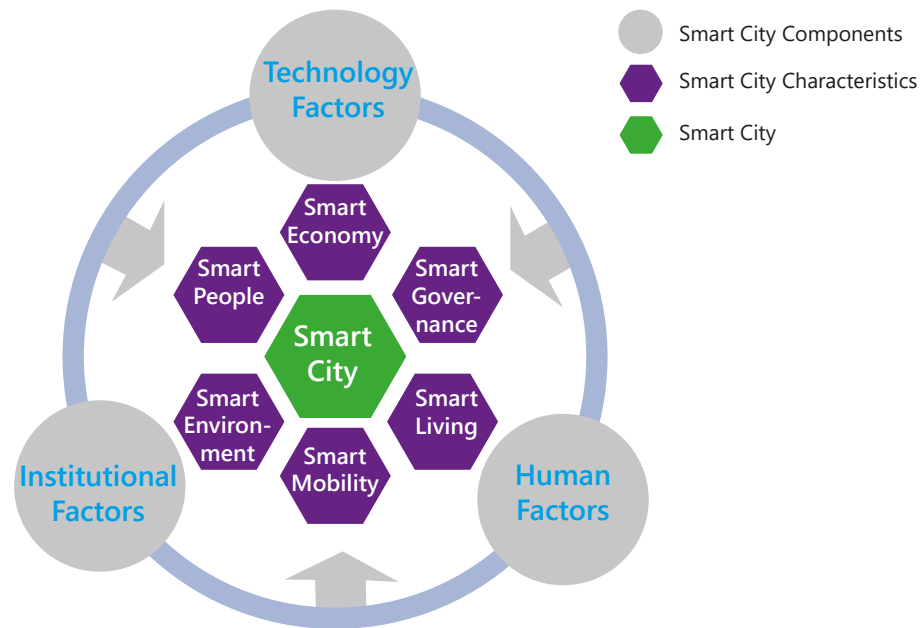
Figure 2. Relationship Between Components and Characteristics of Smart Cities (Mapping Smart Cities in the EU, 2014)

The organisations that took part in the study prioritised the potential smart city applications in Çanakkale as shown below (Figure 3). As a result, Smart Environment and Smart Transportation applications emerged as top priorities. This finding is compatible with the search conference held as part of this project: 1. Smart Environment, 2. Smart Transportation, 3. Smart Economy.
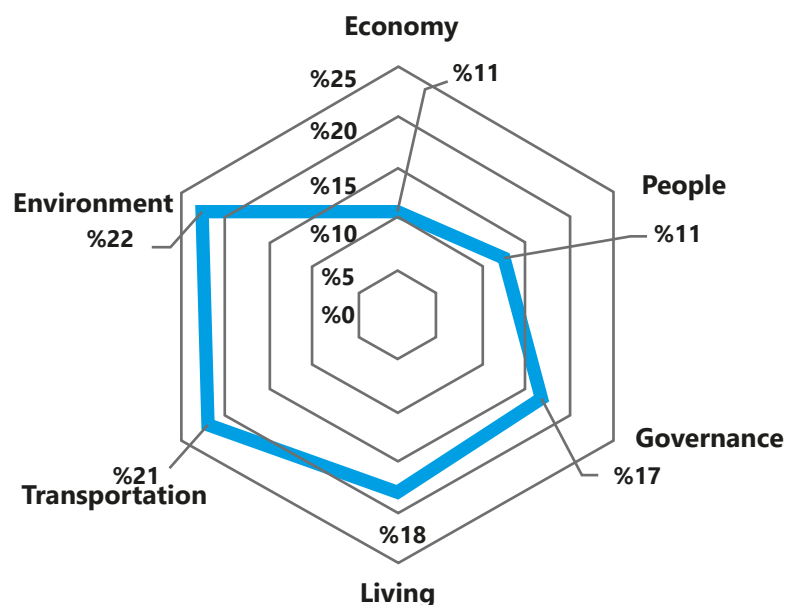
Priority Objectives of Smart City Applications

Figure 3. Priority Objectives for Smart City Applications in Çanakkale

Priorities for Smart Environment

Participants shared their opinions as to which applications need to be prioritised out of the above-mentioned smart city components. 'Smart Grids' and 'Smart Buildings' stand out as the top priorities under the Smart Environment domain (Figure 4), while 'Early Warning Systems' emerged as another key application. The recent earthquakes that have occurred frequently, especially in Ayvacık, reveal the importance of this matter. The concept of 'Resilient Cities' refers to minimising the potential effects of disasters such as earthquakes and epidemics and recovering in the shortest time possible.
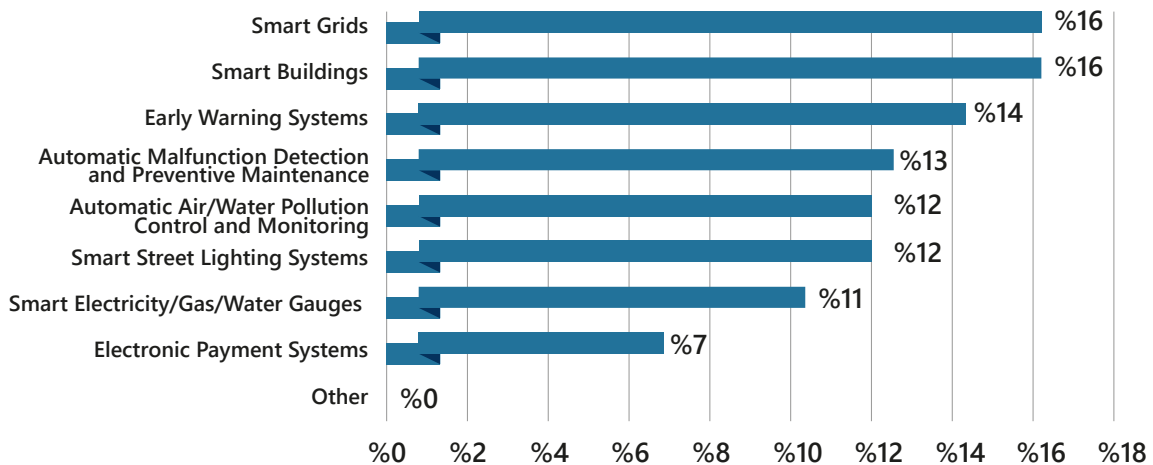
Figure 4. Priorities for Smart Environment Applications

Priorities for Smart Transportation

'Traffic Monitoring Systems' and 'Smart Junctions' stand out as top priorities under the Smart Transportation domain (Figure 5). This indicates that reducing congestions by managing traffic effectively and introducing applications that ensure a steady flow of traffic are considered a priority. Another key priority is 'Advanced Passenger Information Systems' that provide various information such as the weather, accident sites and best route to destination for current or future travel, which is important to manage transportation demands and improve the decisions drivers make in traffic (see: Smart Transportation Systems for Road Transport, Dissertation, Özhan Yılmaz, 2012, Information Society Department, Ministry of Development).
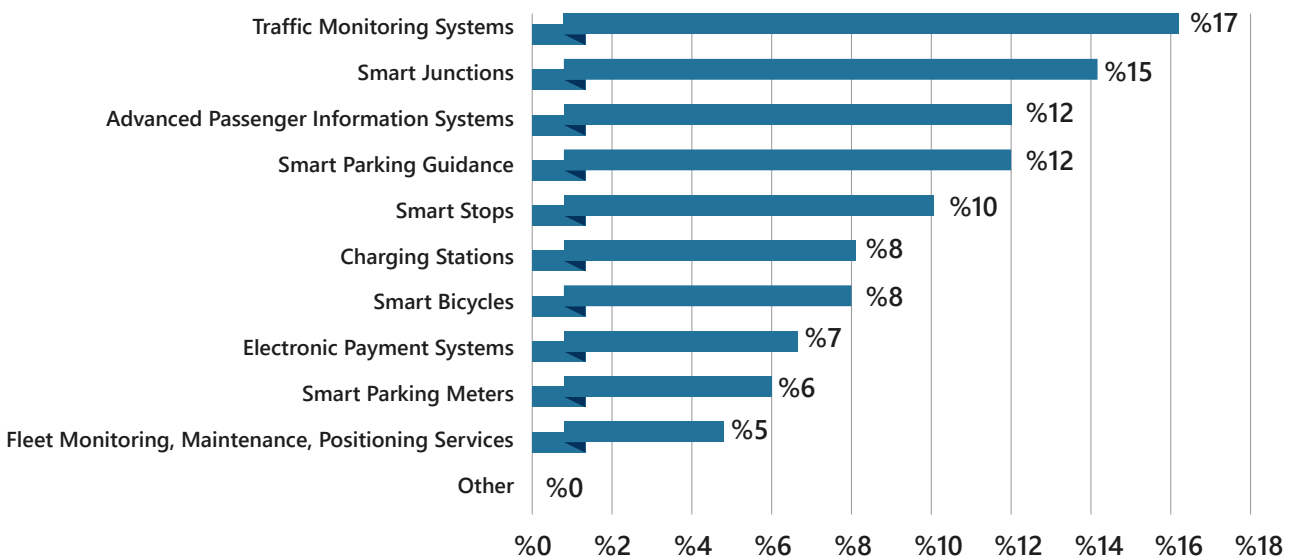
Figure 5. Priorities for Smart Transportation Applications

Priorities for Smart Governance

Under the Smart Governance domain, 'online services for citizens via internet/smart phones' and 'integrated services managed from a single centre using real-time data' emerged as key priorities (Figure 6). The e-government and e-municipality applications are the first online services that come to mind. It is important that the scope of these services is further expanded. As for 'integrated services managed from a single centre using real-time data', ICT-enabled applications and services for citizens regarding disasters and emergency situations have priority given that Çanakkale, in particular, is a first-degree seismic zone.
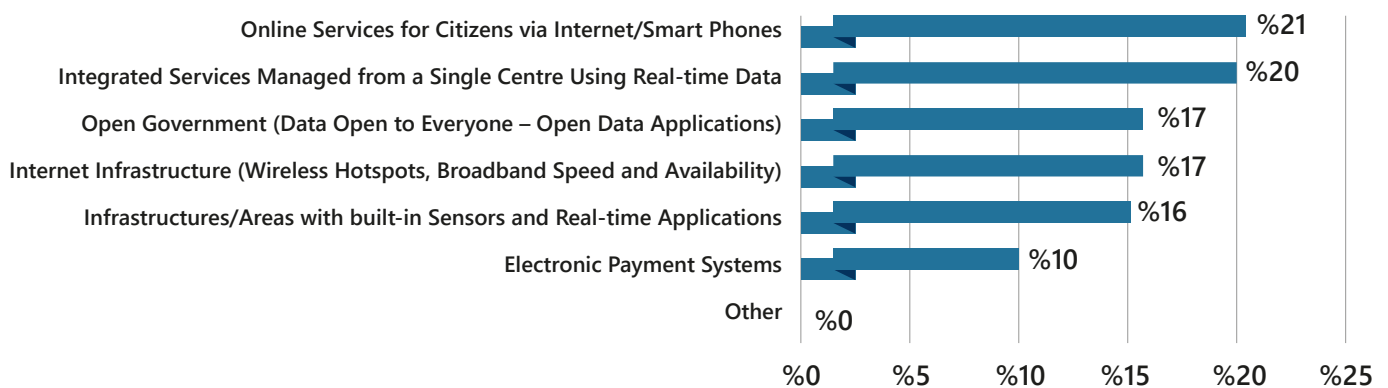

Figure 6. Priorities for Smart Governance Applications

Another key aspect of Smart Governance that emerged is 'Internet infrastructure (wireless hotspots, broadband speed and prevalence)'. The European Parliament, the EU Council and the EU Commission have launched a 'WiFi4EU' initiative to offer free Internet access to European citizens in public areas, local government buildings, parks, libraries and other public spaces. A budget of 120 million Euros is planned for this initiative to set up wireless hotspots across the EU in 6,000 to 8,000 municipalities by 2020.

Priorities for a Smart Economy

According to the participants in this study, 'technology initiatives built on new business models' is the top priority for a Smart Economy (Figure 7). Concepts like e-business models, big data applications, sharing economy and circular economy are shaping the new business models required by a smart economy. New business models are expected to make major contributions to the city's economy, particularly in agriculture and tourism. As 2018 has been declared the Year of Troy, smart applications in tourism could be prioritised.

'Actions to increase productivity in the manufacturing industry' is another major priority under the Smart Economy domain. The top three technologies and sectors believed to benefit most from the added value created by 'Industry 4.0' applications are provided below (see: A Technology Road Map for Smart Manufacturing Systems, TUBITAK 2016):
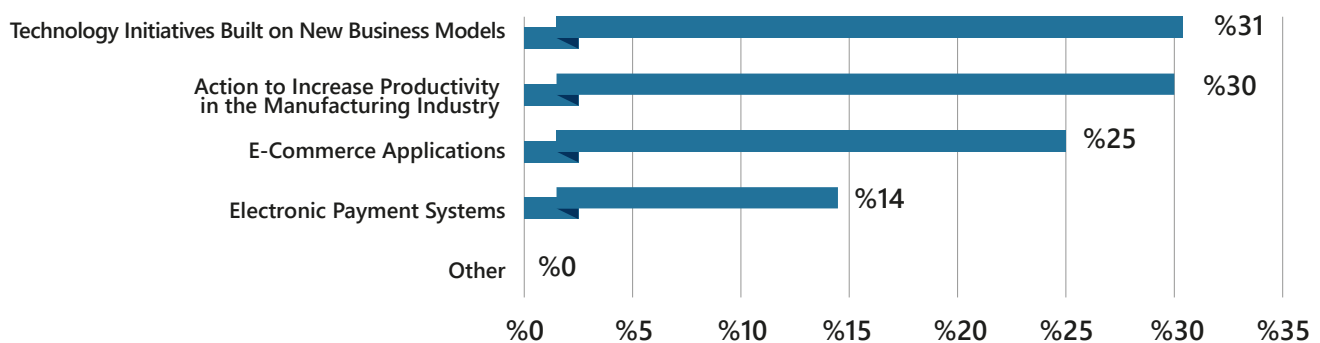

Figure 7. Priorities for a Smart Economy Applications

Priorities for Smart People

'Online education opportunities for citizens' is considered the top priority when it comes to Smart People (Figure 8). Online courses that support lifelong learning are preferred both because they are scalable and offer cost-effective and free education opportunities to citizens.

Online education for citizens includes a range of topics such as Safe Internet Use, Reading and Writing Poetry, Healthy Eating, Family Structure and Relationships, Introduction to Entrepreneurship, Earthquake Readiness etc.
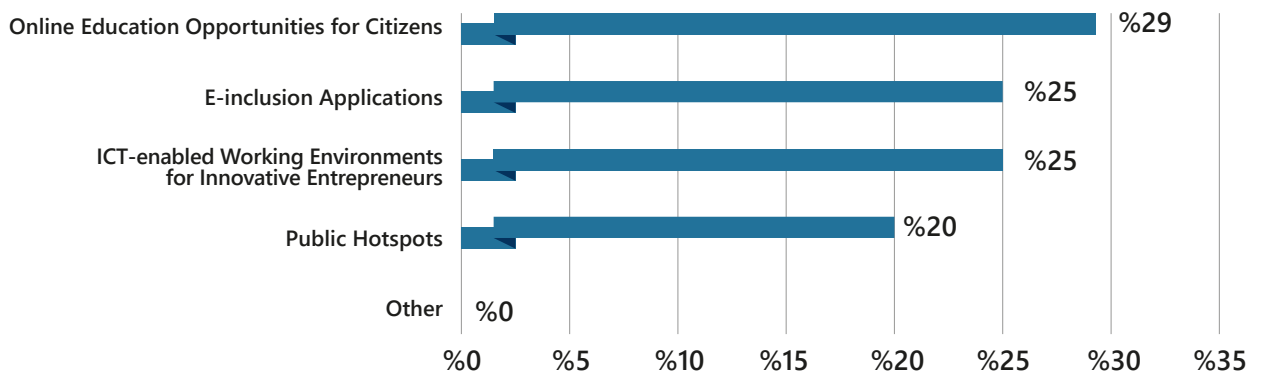
Figure 8. Priorities for Smart People Applications

Priorities for Smart Living

With respect to Smart Living, participants indicated 'Safe Living' and 'Healthy Living' as the top priorities (Figure 9). 'Crime Prevention Technologies', 'Crime Maps' and 'Crime Projections' are also among the applications for Safe Living. As for Healthy Living, applications such as 'Technology-Assisted Independent Living' and a 'Patient-Oriented Healthcare System' that collects patient data in a single location stand out.

Figure 9. Priorities for Smart Living Applications

CRITICAL SUCCESS FACTORS, CHALLENGES AND BRAND VALUE

After identifying the priorities for smart city applications, the participants evaluated the challenges of implementing such applications as well as the critical success factors.

Critical Success Factors

According to the participants, out of the critical success factors (Figure 10) for smart city applications in Çanakkale 'co-operation between organisations' stands out as the most important one. 'Innovative approaches' is another key factor, which is followed by 'financial adequacy', 'ICT expertise', and 'citizen inclusion and adaptation'.

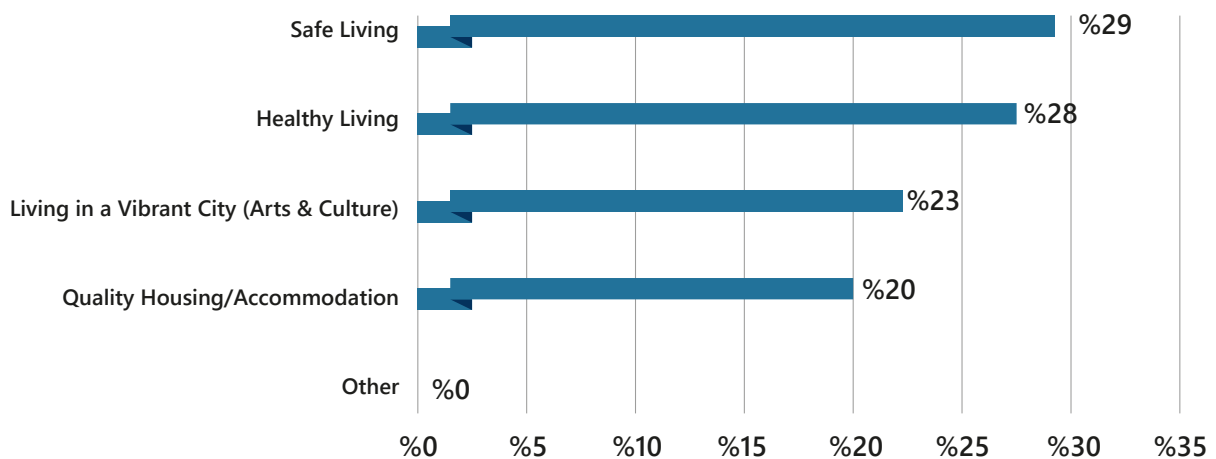In the 2016 Turkey Smart City Assessment Report, 'co-operation between organisations' ranked fourth while the level of awareness for 'co-operation between organisations' in Çanakkale topped the list, nearly doubling the nation-wide rate. This finding is compatible with 'co-operation between organisations' being identified as the top challenge in terms of smart city applications in Çanakkale.

Factor	Value
Co-operation Between Organisations	%15
Innovative Approach	%14
Citizen Inclusion and Adaptation	%11
Financial Adequacy	%11
Information and Communications Technology (ICT) Expertise	%10
Smart City Knowledge and Experience	%8
Geographical Information System (GIS) Infrastructure	%7
Visionary Leadership	%7
Prediction of Application Risks	%4
Integrated Approach	%4
Political Factors	%3
Standards and Interoperability	%3
Legislation on Smart Cities	%3
Other	%0

Figure 10. Critical Success Factors for Smart City Applications in Çanakkale

Key Challenges

Next after 'co-operation between organisations', participants named 'financial adequacy' and 'citizen inclusion and adaptation' among the key challenges for smart city applications (Figure 11). In the case of Çanakkale, 'citizen inclusion and adaptation' has been voiced more strongly compared with the 2016 Turkey Smart City Assessment Report. The same holds true for 'co-operation between organisations'.
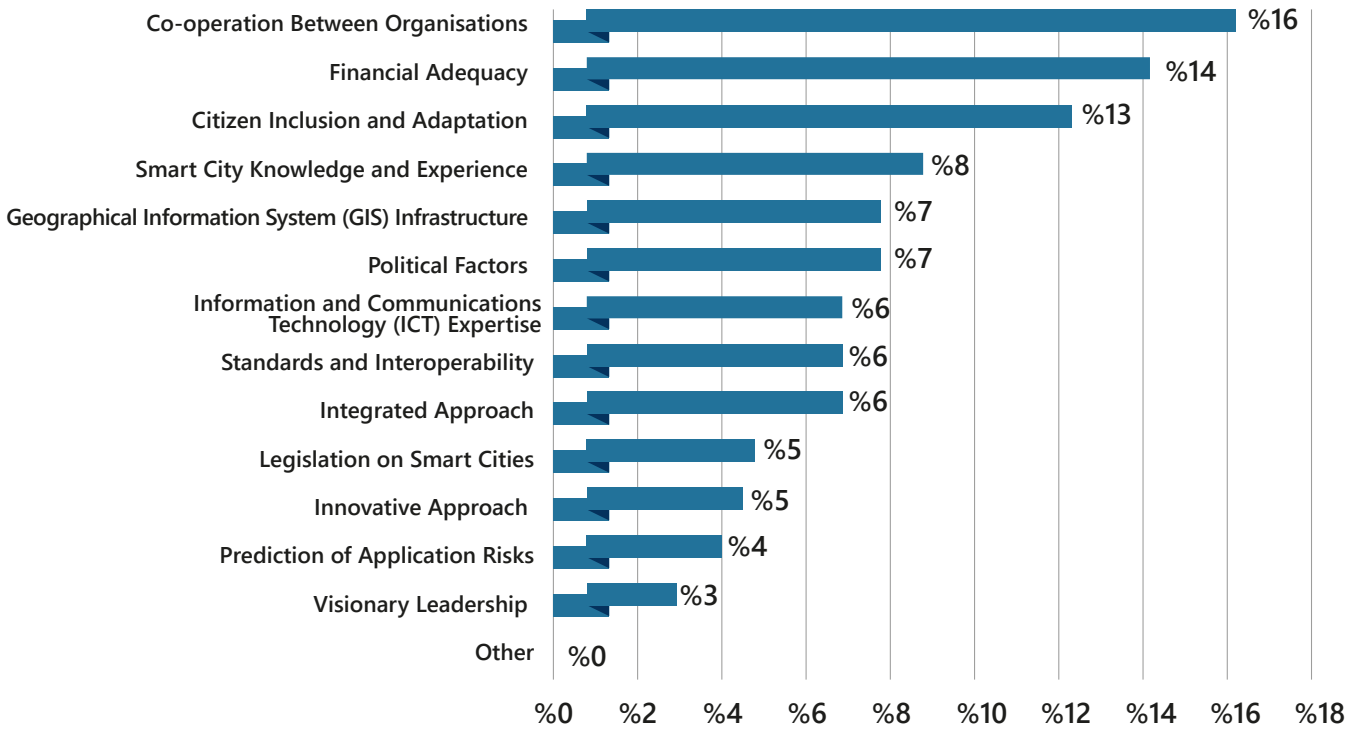
Figure 11. Key Challenges for Smart City Applications in Çanakkale

Smart City and Sustainability, Competitiveness and Brand Value

Out of the respondents, 95 percent expressed their agreement with the following proposition: "Çanakkale's competitiveness can be increased by contributing to its liveability and sustainability through technology, while a Smart City Vision for Çanakkale can support increasing its brand value" (Figure 12). Close to half of the respondent expressed that they "strongly agree" with this statement.
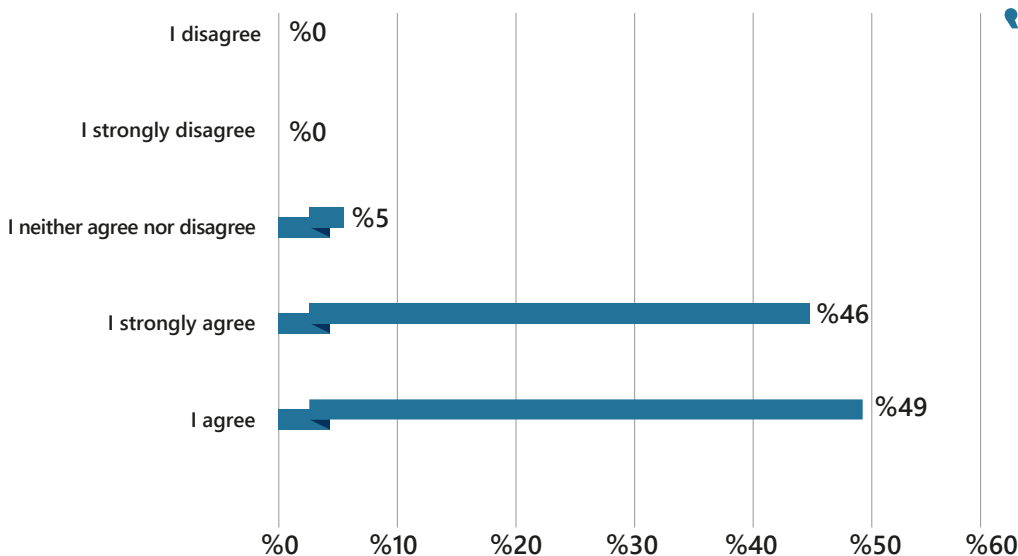
On the other hand, all of the participants noted that they believe it would be beneficial for local data collected from smart city applications to be made available to develop ICT-enabled innovative solutions, upholding data security and confidentiality.

Figure 12. Impact of Çanakkale's Smart City Vision on Brand Value

PROPOSED VISIONS AND SOLUTIONS

Together with the participants in the stakeholder map, Çanakkale's current challenges and needs were identified from a smart city perspective through collective thinking, taking into account previous work. Solutions were proposed for the current challenges and needs, after which these solutions were analysed in detail. The smart city visions that were developed later on by organisations and youth associations individually are provided below.

At the end of both collective thinking workshops, participants came up with their own visions, in light of the visions and mission statements of various organisations in Çanakkale and a series of selected city visions.

Participants from Organisations
Vision 1

A ÇANAKKALE that is focused on education, culture, tourism and ecology, is technology-enabled, offers a high quality of life, is integrated with the international community, uses energy efficiently, is responsive to natural disasters, and embraces a participatory approach and tolerance.

Participants from Organisations
Vision 2

A ÇANAKKALE where the city contributes to its citizens and citizens contribute to their city, raises environmentally friendly younger generations, and upholds peace above all.

Participants form Youth Associations
Vision 1

A ÇANAKKALE – capital of happiness and peace – that embraces diversity, offers high quality of life through its natural and historic beauties and entrepreneurial and innovative approaches.

Participants form Youth Associations
Vision 2

A ÇANAKKALE that upholds production over consumption, can generate its own energy, and makes its voice heard across the globe through an entrepreneurial and innovative society.

Solutions Proposed
by Organisations

Following the Smart City Seminar on 30 March 2017, the Collective Thinking Workshop took place on 31 March 2017 with 28 participants from 18 units in 10 organisations. Participants discussed the current issues in Çanakkale based on the smart city characteristics and previous actions taken and suggested the following solutions (Figure 13).

Procure public transport vehicles that run on renewable energy
Promote electric vehicles
Increase the number of bicycles and bicycle stations, offer more attractive prices
Build a rail system and encourage public transportation
Build a cable car system for student transport
Provide a dedicated lane for school buses
Close the marketplace to traffic
Embed Sarıçay in the transportation system
Increase the number of car parks
Stipulate compulsory underground car parks and solid waste management for new buildings
Raise citizen awareness on transportation
Create a Traffic Control Centre and share data through mobile apps
Create a Disaster Recovery Centre
Consider relocating GESTAŞ, green areas, public organisations to the outskirts and transform these places into green areas, create a campus for public buildings, focus on the urban protected area (SIT) issue and prioritise pedestrians in the city plans
Collect sound and noise data through sensors
Use solar energy for street lights, place solar energy panels on top of the marketplace (Cuma Pazarı) and incentivise solar energy when licensing buildings larger than a certain size
Introduce smart water management and increase the quantity of smart irrigation systems
Introduce wastewater treatment and use treated water in agriculture
Raise awareness and responsiveness to environmental issues
Create entities that offer software courses, in particular, and adopt human resources development strategies that meet the mid-level employee needs
Take measures to increase the use of technology
Increase citizen participation through structures such as City Councils, Neighbourhood Councils

Figure 13. Solutions Proposed by Organisations

Solutions Proposed by Youth Associations

For the young participants who were unable to attend the first collective thinking workshop, an additional workshop was organised on 12 April 2017 to include them in the efforts. A total of 27 young people attended the workshop led by the Çanakkale Koza Youth Association. The participants identified Çanakkale's current problems in light of the smart city characteristics and previous actions taken and came up with the following solutions (Figure 14).

Build solar powered charging units
Promote and increase the use of solar energy across municipal and public organisations
Use smart traffic lights
Put power lines underground
Create continuous bicycle lanes
Build a tram line between Esenler and Kepez
Set up a gondola line for Sarıçay
Provide wireless hotspots and fiber optic networks across the city
Lift the bandwidth cap
Create a recycling centre
Erect new buildings that fit in with the cityscape, produce their own energy and have parking spaces in place of the public buildings that are taken down
Develop an app that shows how many bikes are available in each station and remaining credit on CABIS card
Place sensors on garbage bins across the city
Provide a system to deliver accumulated waste to municipalities
Restore and convert old, unused buildings into cultural, arts and science centres
Keep public libraries open 7/24 and design rooms for group work in these libraries

Figure 14. Solutions Proposed by Youth Associations

ROADMAP AND RECOMMENDATIONS

The first phase of the Çanakkale On My Mind project has been completed. Spearheaded by Kale Group in co-operation with TBV and facilitated by Novusens, the project aims to expedite Çanakkale's transformation into a smart city and increase the quality of life by contributing to the city's liveability and sustainability through technology to increase its competitive-ness and raise 'smart city' awareness'.

The Çanakkale On My Mind project intends to spark Çanak-kale's journey towards a smart city by creating a smart city transformation vision and kicking off the process. This report, to which the city has made significant contributions through a participatory approach, is expected to serve as guidance to everyone on this smart city transformation journey.

This section examines the recommendations and road map in light of the first phase. Before moving on to the next phases, the executive summary is planned to be presented at the Provincial Coordination Board and City Council meetings and private meetings with the senior managements of relevant organisations. According to the evaluations during these meetings, the next phases of the smart city transformation process will be crystallised under the leadership of local governmental organisations.

SUCCESS FACTORS

Achieving the targeted impact for the smart city transformation investment depends on good planning and efficient management of all phases in the process. Some of the factors that impact the success of the smart city transformation journey include:

✔ Visionary Leadership

✔ Smart City Vision

✔ Co-operation between Organisations (Public Sector-Private Sector-NGOs-Universities)

✔ Innovative Approach

✔ Efficient Smart City Collective Wisdom Platform

✔ Citizen Participation

✔ Financial Adequacy

✔ Enabling Technologies and Expertise

Road Map Recommendations

The phases involved in Çanakkale's smart city transformation are repeated below with a view to shed light on the next actions (Figure 15).

1 UNDERSTAND
Identify the needs, issues and priorities
STAKEHOLDERS:
• Citizens
• Businesses
• Universities
• NGOs
• Local/central decision-makers

2 VISION
• Identify a smart city vision
• Establish a smart city platform

3 STRATEGY
• Define focus areas
• Identify technology enablers
• Identify innovation accelerators
• Determine project selection criteria

4 ACTION PLAN
Prioritisation of programme and projects
• Quick wins
• Large-scale projects
• Getting approvals

5 IMPLEMENTATION and MONITORING
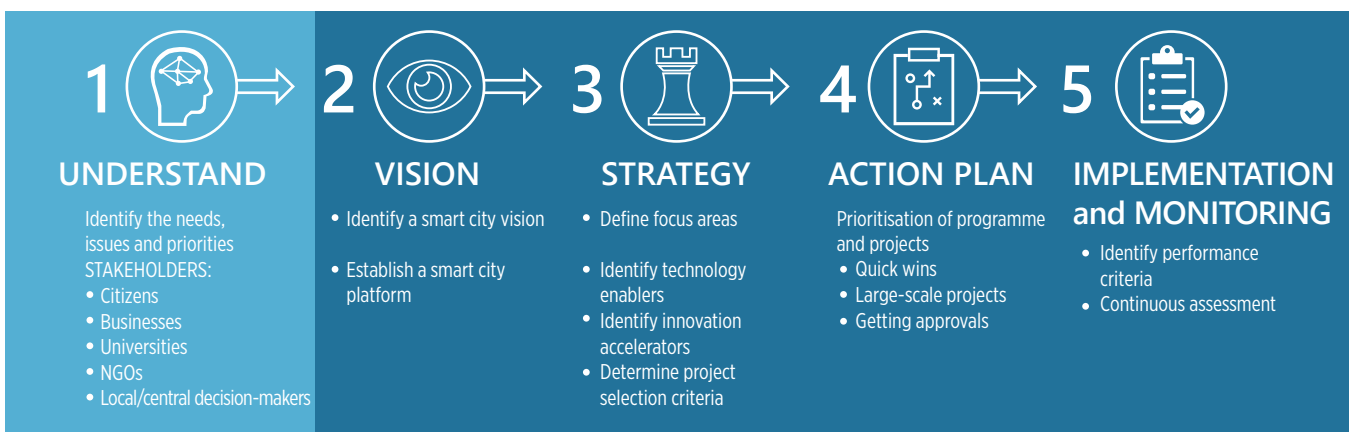• Identify performance criteria
• Continuous assessment

Figure 15. Çanakkale's Smart City Transformation Process

The proposed road map for the remaining four phases in the smart city transformation process are as follows:

Create a Smart City Collective Wisdom Platform for Çanakkale:
This platform is needed in order to coordinate the actions to transform Çanakkale into a smart city; identify a common vision and focus areas taking into consideration the visions developed in phase 1; reach agreement on recommendations; and, ensure a participatory approach. International examples show that local government organisations have led the formation of similar platforms with public-private and university partnerships and, in some cases, with central funding. In such examples, members of these platforms include relevant NGOs as representatives of citizens and private organisations.

Phase 2
VISION

Create a Smart City Project Office for Çanakkale:
A project office can be created for the Collective Wisdom Platform or each platform member can set up their own smart city units, task forces or commissions to ensure coordination in their organisations. It is highly recommended that organisations such as municipalities and universities, in particular, set up units/centres for planning and coordination as well as research.

Develop a Smart City Strategy for Çanakkale:
Taking into account that local government organisations in Çanakkale have their own vision and mission statements, the following actions are planned so that these organisations update their relevant documents and plans from a smart city viewpoint, while increasing coordination between organisations and using resources efficiently:

- Identify priority focus areas for Çanakkale
- Determine a short/mid-term theme(s)/concept(s) that differentiates Çanakkale and develop communication plans to associate the city with this theme(s)/concept(s)
- Identify selection criteria for smart city project proposals
- Identify the technology enablers and innovations accelerators planned to be used in the projects
- Design the strategy in line with its impact on economic growth, economic benefit and social benefit
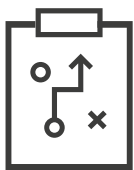
Phase 3
STRATEGY

Identify and Prioritise Smart City Programmes and Projects
- Determine quick win projects and required resources (See Annex 1 for details)

Proposed Quick Win Projects:
These are projects that do not require a great amount of time and money and can be implemented quickly with public support. The potential projects for Çanakkale include:

- Expansion of wireless network accessibility
- Setting up of charging units
- Smart Garbage Collection Management
- Public Internet Access Centres
- Establishment of a City-Lab
- Technology-Assisted Healthy and Independent Living Centre
- Smart Parking Guidance
- Smart Street Lighting Systems
- Automatic Air/Water Pollution Control and Monitoring
- Çanakkale Traffic Monitoring Application
- GESTAS Passenger Information System
- E-participation application
- Çanakkale Open Data Portal
- Mobile city tourism application
- Identify Large Projects (Initiatives) and Resource Requirements
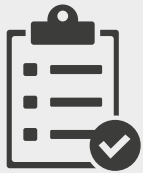
Phase 4
ACTION
PLAN

Create Financial Resources for a Smart City

The guidance and decisions of the Provincial Coordination Board and local governments are important in identifying potential financial resources. Provincial and regional organisations that make investments as well as professional organisations and chambers of industry and commerce play a key role in identifying sources to fund projects.

- Ensure relevant organisations in the city allocate budgets for smart city projects in their annual budgets
- Create a Joint City Fund (programme or project based support in cash and/or in kind from the relevant stakeholders). A workshop for investor provincial and regional organisations as well as local government organisations is recommended.
- Provide smart city supports from central organisations (e.g. Ministry of Interior, Ministry of Development-South Marmara Development Agency, TUBITAK, Provincial Bank etc.)
- Apply to the relevant European Union funds
- Get the relevant project approvals

Other Suggestions for Çanakkale's Smart City Action Plan

- Develop international partnerships for a smart city
- Identify smart city 'sister' cities and universities (a city/university from Australia and New Zealand and/or Europe)
- Become a Follower City in the European Union's 2017 Horizon 2020 programme and share knowledge and experience through this programme
- Join the 'Covenant of Mayors' initiative
- Join leading smart city platforms ('City Protocol', 'Smart City Council' etc.) and attend international smart city conferences (e.g. Smart City EXPO World Barcelona etc.)
- Take actions to get listed in the smart city rankings
- Develop a Smart City Master Plan taking into account the impact of the Çanakkale Bridge and Thrace Mega Corridor
- Launch a 'Resilience Programme' that provides smart solutions taking into account Çanakkale's seismicity
- Organise events to produce smart city solutions that encourage citizens and young people to participate

Phase 5
IMPLEMENTATION and MONITORING

Create a Monitoring and Assessment Process

Like in the other phases, the Smart City Collective Wisdom Platform needs to play a key role in this phase too. It will be possible to monitor the programme and projects and, if necessary, make corrections, by assessing and sharing field data provided by local government organisations that are implementing projects.

- Identify critical performance indicators
- Create a continuous assessment process

CONCLUSION

Smart city projects require visionary leadership from local governments just as much as they need participation and co-operation between organisations as is the case in successful international examples like Amsterdam, Barcelona, Copenhagen and Montreal. While local government organisations spearhead this transformation in almost all of the applications, public-private and university partnerships are also evident. The smart city platforms that have been created are managed by teams that work with all stakeholders in an equal, impartial, transparent and non-profit manner for social benefit. In light of these examples, Çanakkale's thematic priorities like tourism and agriculture that have been identified in this project and prior studies will be addressed under the road map provided above. Contributing to Çanakkale's liveability, workability and sustainability is possible by keeping up actions that enhance the value and accessibility of Çanakkale's natural and cultural resources, merging these with physical infrastructure and smart technologies, and bringing together Çanakkale's social, human and creative resources through inclusive methods. This way, Çanakkale will set an example both nationally and internationally, while increasing its visibility. That is precisely why Çanakkale is on Our Mind.

ANNEX 1 – PROPOSED QUICK WIN PROJECTS

When considered that transforming into a smart city is a rather long process, providing concrete project outcomes and benefits is important to garner public support to see this transformation through. Accordingly, launching quick win projects that can be implemented quickly without requiring a lot of funding and provide observable results play a key role. Along these lines, the quick win projects proposed for Çanakkale are as follows:

- **Expansion of wireless network accessibility:** increase the number of high-speed Wi-Fi hotspots in priority areas (parks, streets, museums, libraries, buses etc.) in downtown Çanakkale, offer this service through a mobile app available in Turkish and English.

- **Charging units:** place solar-powered or grid-powered charging units (on benches or street lights) in priority areas (parks, streets etc.).

- **Smart Garbage Collection Management:** install sensors on the garbage bins in the city.

- **Public Hotspots:** Where appropriate, design spaces for group work and meetings in public libraries that are equipped with information and communication technologies to enhance citizens' IT competencies and increase the utilisation of applications such as e-municipality/e-government/online banking etc., indirectly increasing interest in libraries.

- **City-Lab:** create a "Living Lab" environment that enables young people to come up with ideas/designs/solutions for the city's issues and experience their solutions in real environments.

- **Technology-Assisted Healthy and Independent Living Centre:** monitor the health of senior citizens in the Golden Years Life Centre through wearable technologies and share the relevant data using ICT.

- **Smart Parking Guidance:** apps that enable users to search available parking spots in downtown areas.

- **Smart Street Lighting Systems:** street lighting systems that have LED lights, Wi-Fi hotspots, security camera systems, and air/noise pollution sensors.

- **Automatic Air/Water/Noise Pollution Control and Monitoring:** monitoring key locations for air/water/noise pollution through fixed or mobile sensors.

- **Çanakkale Traffic Monitoring App:** sharing real-time traffic data and important notifications for key routes in Çanakkale (including sea lines to Kilitbahir, Eceabat etc. and the islands), monitoring traffic across the city through cameras.

- **GESTAŞ Passenger Information System:** providing real-time information for passengers about ferry capacities and availabilities for their current/future journeys.

- **E-participation app:** launch apps that encourage citizen involvement by starting off with basic mobile surveys for colour choices, route preferences etc.

- **Çanakkale Open Data Portal:** launch an Open Data Portal to create more social benefit through the data collected in Çanakkale currently and in the future (e.g.: including data such as vehicle and pedestrian density in key locations, number of incoming and outgoing vehicles through GESTAS, bicycle availabilities at the CABIS stations etc.).

- **City Tourism Mobile App:** a mobile app and/or smart kiosks providing up-to-date information about the city and events for domestic and international tourists.

ANNEX 2 – INTERNATIONAL BEST PRACTICES

This section examines cities that have launched successful applications during their smart city transformation in line with their strategic plans. Every effort has been made to choose cities and applications from similar cities in different parts of the world that set a model for Çanakkale.

Amsterdam/NETHERLANDS

Amsterdam is the only city in the world where traffic pollution created by pedestrians and cycling is higher than traffic pollution created by vehicles. Cycling and walking account for 67% of all trips. However, Amsterdam features a slew of innovative smart city applications that are well ahead of smart bicycles. Amsterdam ranks third in Boyd Cohen's list of Smartest Cities in Europe.

With a population of 813,562, Amsterdam's population density is also pretty high: 4,908 people per km2. Compared with the 1990's, Amsterdam aims to reduce its carbon emissions by 40% by 2025 and 75% by 2040. To help reach these sustainability goals, the Amsterdam Smart City platform (ASC) was founded in 2009 by the Amsterdam Economic Board, Amsterdam Municipality, Internet service provider Liander and telecom operator KPN.

The ASC platform is a partnership created by businesses, decision makers, research organisations and Amsterdammers that launches and advances smart city projects in Amsterdam. The platform has a central office where a few people work. In 2013, the platform turned into an organisation of 70 stakeholders implementing 37 projects. The platform's budget for 2009-2011 was 3.4 million Euros, of which 40% came from EU funds, 40% private sector funds and 20% public resources. (https://amsterdamsmartcity.com)

Copenhagen/DENMARK

Copenhagen set off with a vision to be the city "with the best urban environment and life in the world" and set the following goals to this end: (See: Copenhagen Smart City)

- Climate capital (zero carbon emissions)
- World's best city for cycles
- A green and blue capital city
- A clean and healthy big city

Chosen Europe's green capital in 2014, Copenhagen aims to become the leader in green growth through data and technology. Copenhagen's smart city strategy is provided below.
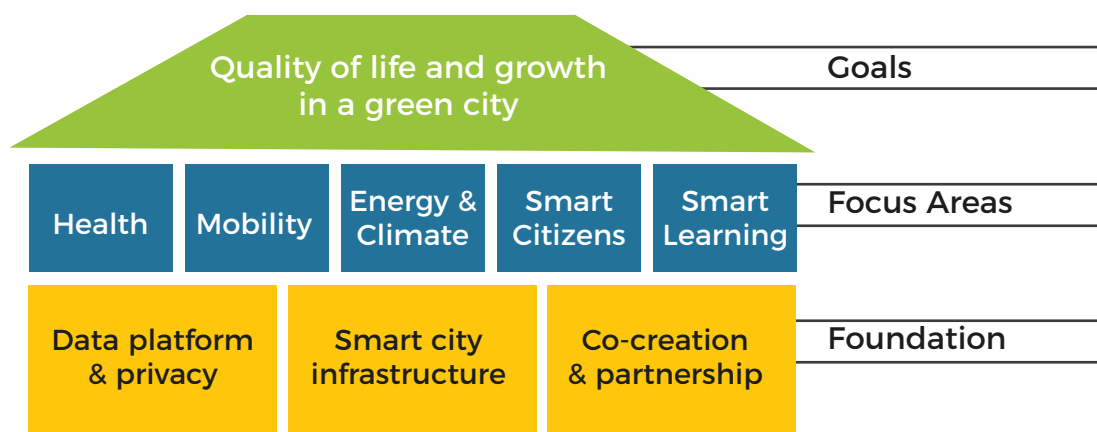
Note: Copenhagen has 2,000,000 inhabitants with 580,000 people living in the city proper. The population density is 6,800 people per km2.

Montreal/CANADA

Montreal's vision is to become the world's leading smart city in 2017. To this end, Montreal aims to design and deliver a unique quality of life and create economic through its strategy, innovation built on co-operation, advanced technologies and bold approach. Montreal plans to become a leading smart city like New York, Lyon, Barcelona and Amsterdam with its 2014 Smart and Digital City Strategy.

Montreal's Smart and Digital City Action Plan for 2015-2017 consists of six programmes designed through ideas submitted by citizens, business and public stakeholders.

MtlWiFi offers everyone in the city uninterrupted broadband Wi-Fi access which is free-of-charge and easy to use. Launched in 2015, the service provides information to citizens and tourists about historic landmarks using virtual reality. At current, this service is available in the city hall and 43 public libraries.

- Smart City Economic Cluster
- Participatory Democracy
- Smart Mobility
- Ultra High-speed Multiservice Network
- Public Wi-Fi (MtlWiFi)
- Digital Public Services ('Je Fais MTL' Initiative)

Note: Montreal has 2,006,966 inhabitants and a population density of 954 people per km2.

Auckland/NEW ZEALAND

Auckland ranks fifth in Boyd Cohen's Smartest Asia-Pacific Cities listing. In addition, Auckland recently became the ninth partner of an important platform to transform municipal services through the use of information and communication technologies and big data in areas such as transportation, energy and buildings. Auckland generally tops the quality of life indices thanks to its mild climate, coastline stretching across 1,600 km, low crime rates and balanced distribution of income.

Auckland's smart city vision makes it the most liveable city in the world.

Auckland aims to achieve this vision by transforming into a smart city through smart citizens and smart infrastructure. Auckland's innovation plan to become a smart city consists of developing an innovation eco-system that is built on co-operation, talent and funding. The advisory board has decided to prioritise high-speed broadband Internet access, transportation systems and healthcare services.

In general, projects have enabled the development of effective and efficient smart 'sensing' systems and production of data analytics that serve decision-making mechanisms. Data produced for air quality, water quality, traffic and pedestrian counts through visualisation tools create a more accurate picture of how these cities work and how citizens interact with their urban environment, while enabling spending to be more effective (see: EC Evaluation Consult, Land Information New Zealand, Smart Cities Evaluation Report, 2016).

Note: Auckland has a population of 1,415,550 with a population density of 2,700 people per km2.

Columbus/USA

Columbus has a vision to be a community that provides health and prosperity for all of its citizens.
● A beautiful city provides clean transportation options that serve the mobility demands of the city.
● A healthy city provides safe and inviting opportunities for non-motorised travel and smart technology with a complete digital network that links people to services such as healthy food and health care.
● A prosperous city connects workers to jobs and employers to workers, gets goods to market, supports world-class institutions, and provides reliable travel options affordable to a range of household budgets.

Smart City Strategy

The Columbus Smart City Strategy consists of five sections

✔ Access to jobs
✔ Smart logistics
✔ Connected visitors through real-time digital communication
✔ Connected citizens through real-time digital communication
✔ Sustainable transportation

Priority Areas

Columbus focuses on four key challenges:

✔ An aging population
✔ A growing younger population that is moving to the dense urban areas
✔ Mobility challenges in select neighbourhoods.
✔ A growing population with related housing and commercial, and passenger and freight, and environmental issues.

Note: The Columbus metro area has a population of 2,400,000 and the city proper 854,000. The population density is 1,399 people/km2.

Singapore/Singapore

Known for its 'Smart Nation' vision, Singapore's motto is "Many smart ideas, one smart nation." Last year, Singapore opened the Gardens by the Bay, a park featuring 18 hi-tech artificial trees.

Singapore has also managed to turn its top problem – water dependency on Malaysia – into a strength thanks to policies supporting innovations that overcome water scarcity. Singapore boasts 100 companies that generate 370 million USD in annual revenues by selling rainwater collection and water recycling technologies to the whole world. Since 2006, Singapore's water technologies industry has generated revenues north of 7 billion USD from international projects.

One of the factors behind Singapore's success is the leadership that the city's administration has demonstrated in adopting easy and widespread high-speed broadband Internet access. According to the Economic Intelligence Unit's report, Singapore reached 95% household coverage with an adoption rate of 45% in 2014. Similarly, according to the International Telecommunications Union Singapore ranked second in the world for mobile-broadband subscriptions per 100 inhabitants.

Note: Singapore has a population of 5,750,000 and total area of 719.1 km².

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About the Stakeholders

About Kale Group

This year marks the 60th anniversary of Kale Group, one of Turkey's global industrial groups. Founded in 1957 by Dr. (h.c.) Ibrahim Bodur, Kale Group's journey that started off with ceramic tiles expanded to include building materials, building chemicals, energy, defence and aviation. Today, Kale Group has 17 companies, each a leader in their field, and more than 5,000 employees making it the third biggest ceramic tiles manufacturer in Europe and the 12th biggest in the world, while becoming Europe's fifth biggest building chemicals manufacturer. Kale Group also has partnerships with global leaders for international projects in the defence and aviation industries. (www.kalegrubu.com.tr)

About TBV

The Turkish Informatics Foundation (TBV) was established in April 1995 with the core objective of contributing to creating the infrastructure for Turkey's transformation into an information society and conducting economic and social studies, designing projects and ensuring their implementation through scientific research and development initiatives to increase the share of IT in the economy. TBV's founder and current chairman is Faruk Eczacıbaşı (http://www.tbv.org.tr/).

About NOVUSENS

Based in Ankara, the NOVUSENS Innovation and Entrepreneurship Institute was established in 2009 (http://www.novusens.com/). NOVUSENS is an independent think tank that develops innovation policies and strategies for cutting-edge technologies that are part of our lives, designs technology-enabled innovative models that improve the quality of life, and focuses on creating new opportunities to boost economic growth.

Establishing the Big Data Institute in 2013 and Smart Cities Institute in 2014, NOVUSENS conducts research in these fields while also offering consulting and training services. The Çanakkale's Roadmap to Becoming a Smart City report was prepared by Berrin Benli and Melih Gezer and facilitated by the NOVUSENS Smart Cities Institute. (http://www.akillisehirenstitusu.com/).

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