Essential of Project Management in Smart city Development

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Abstract— Infrastructure is the backbone of any nation. India is still treated as a developing economy because of the low-infra development and resultant poor standards of living. Railways, roadways, airports, energy, power, ports, communications & urban infrastructure facilities play a vital role in attracting and determining the investments by foreign countries. Infrastructure is, therefore, the key driver of growth for establishing India at global level. With this context, Prime Minister Narendra Modi's vision "Digital India," has set an ambitious plan to build 100 smart cities across the country. It is in this backdrop that his clarion call of `Make in India', `Digital India', or `Smart Cities', requires the entire ecosystem to move from vision to mission mode. This requires a long term vision to re-define the infra needs of India to a ground level, creating responsible groups and delegating the development at root level. A project/program management approach is the best solution to avoid higher costs, delays and to complete each development project with the expected standards. With shrinking project outcomes, shifting global trends and an uncertain economy, this paper summarizes the reason & innovative management process that organizations and governments must shift their thinking and embrace project management as a strategic competency that can reduce risk, cut costs and improve success rates.

Index Terms— Make in India, Smart City, Economic Development, Project Management and process

1 INTRODUCTION

1.1 Smart city: a rising wave

THE world is at an unprecedented level of urbanization. Ten percent of the world population lives in the top 30 metropolises, and 600 cities accommodate its quarter. Currently half of the total population lives in cities. [1] Cities are engines of growth for the economy of every nation, including India. Nearly 31% of India's current population lives in urban areas and contributes 63% of India's GDP (Census 2011). With increasing urbanization, urban areas are expected to house 40% of India's population and contribute 75% of India's GDP by 2030. This requires comprehensive development of physical, institutional, social and economic infrastructure. The trajectory of the rapid urban population growth is not just an interesting fact but requires a demanding imperative for sustainable development and better livability. Development of Smart Cities is a step in that direction. [2]

1.2 Understanding 'Smart City' and the key challenges

The first question is what is meant by a 'smart city'. The answer is, there is no universally accepted definition of a Smart City. It means different things to different people. The conceptualization of Smart City, therefore, varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents. Some definitional boundaries are required to guide cities in the Mission. Some of are listed here as;

• A smart city is one that uses information and communications technologies to make the critical infrastructure components and services of a city —administration, education, healthcare, public safety, real estate, transportation and utilities —more aware, interactive and efficient. [6]

• A city —connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city. [7]

• A city can be defined as smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement. [8]

The value of Smart City can be summarized and created using three dimensions often called as "Triple bottom line"[5];

I. Environmental (Conservation): Environmental component includes resources and managerial infrastructures. It covers water, air, energy and waste management, public and alternative transportation, geographical information, green buildings, green spaces, smart growth, climate change measurement, etc.

II. Economic (growth): Economic component includes public administration and economic factors. It covers governance models, urban regeneration, open data, big data, bandwidth, mobility, cloud computing, security, business intelligence, etc.

III. Social (equity): Social component includes citizens. It covers community life, urban mediation, participatory democracy, social innovation, human-scale cities, civic participation, proximity services, etc.

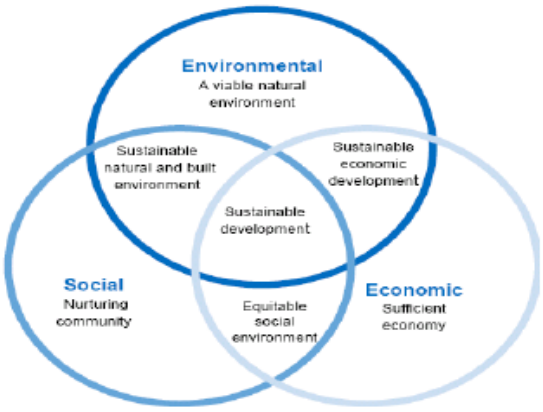

Figure 1: Triple Bottom Line for Basic Smart City Model [5]

1.2.1 Eight critical pillars of India's Smart City Program:

The key challenges for Smart City development can be summarized under eight critical pillars of India's Smart City Program;

Table 1: Eight critical pillars of India's Smart City Program [5]

Eight Critical pillars	The Key Challenges
Smart Governance	• Investments of about US$1.2 trillion will be required over the next 20 years across areas such as transportation, energy and public security to build smart cities in India. • US$1.2 billion allocated for smart cities and FDI norms relaxed • US$83 million allocated for Digital India Initiative • PPP Model to be used to upgrade infrastructure in 500 urban areas • Smart City projects to create 10-15% rise in employment • Ministry of Urban Development has plans to develop 2 smart cities in each of India's 29 states • Delhi Mumbai Industrial Corridor Development Corporation Ltd (DMICDC) plans seven "smart cities" along the 1,500 km industrial corridor across six states with a total investment of US$100 billion
Smart Energy	• Electrification of all households with power available for at least 8 hours per day by 2017 • Establish smart grid test bed by 2014 and smart grid knowledge centre by 2015 • Implementation of 8 smart grid pilot projects in India with an investment of US$10 million • Addition of 88,000 MW of power generation capacity in the twelfth five year plan (2012-17) • India needs to add at least 250-400 GW of new power generation capacity by 2030 • The Power Grid Corporation of India has planned to invest US$26 billion in the next five years • India to install 130 million smart meters by 2021
Smart Environment	• Ministry of New and Renewable Energy has plans to add capacity of 30,000 MW in the 12th Five Year Plan (2012-17) • Water and Waste Water Management • The Indian Ministry of Water Resources plans to invest US$50 billion in the water sector in the coming years • The Yamuna Action Plan Phase III project for Delhi is approved at an estimated cost of US$276 million • About 67% of the rural population continues to defecate in the open, and India accounts for about 50% of the world's open defecation • The Government of India and the World Bank have signed a US$500 million credit for the Rural Water Supply and Sanitation (RWSS) project in the Indian states of Assam, Bihar, Jharkhand and Uttar Pradesh

Smart Transportation	• The Government of India has approved a US$4.13 billion plan to spur electric and hybrid vehicle production by setting an ambitious target of 6 million vehicles by 2020 • Electric vehicle charging stations in all urban areas and along all state and national highways by 2027 Railways • Ministry of Urban Development plans to invest more than US$20 billion on the metro rail projects in coming years • High Speed Rail: The proposed 534 km Mumbai-Ahmedabad high speed rail project will have an investment of around US$10.5 billion • Monorail: India's first monorail project at Mumbai will cost around US$500 million, of which US$183 million has been spent on phase I
Smart IT & Communications	• Cloud computing will evolve into a US$4.5 billion market in India by 2016 • Broadband connections to 175 million users by 2017 • Under the flagship "Safe City" project, the Union Ministry proposes US$333 million to make seven big cities (Delhi, Mumbai, Kolkata, Chennai, Ahmadabad, Bangalore and Hyderabad) to focus on technological advancement rather than manpower Disaster Management • The Government of India and World Bank signed US$236 million agreement for reducing disaster risks in coastal villages of Tamil Nadu and Pondicherry
Smart Buildings	• India is expected to emerge as the world's 3rd largest construction market by 2020, by adding 11.5 million homes every year • The Intelligent Building Management Systems market is around US$621 million and is expected to reach US$1,891 million by 2016 • Smart Buildings will save up to 30% of water usage, 40% of energy usage and reduction of building maintenance costs by 10 to 30%
Smart Health Hospitals	• Health budget up by 27% in FY 2014-15 to US$5.26 billion, with special focus on improving affordable healthcare for all • To establish six new AIIMS like institutes and 12 government medical colleges • Accessible, affordable and effective healthcare system for 1.2+ billion citizens • FDI limit in the insurance sector increased to 49% from 26% • Insurance industry has potential to reach US$1 trillion by 2020 • Indian medical devices market to reach US$11 billion by 2023 • 100% FDI allowed in the medical devices sector under the automatic route • Indian wellness industry is expected to reach around US$16.65 billion by 2015
Smart Education	• The Government of India has allocated US$13.95 billion in the Union Budget 2014-15 for the education sector, up by 12.3% from the previous year. • Budget has allocated US$78.5 million to set-up five new IITs and five new IIMs • The Ministry of Human Resource Development plans to have 1,000 private universities for producing trained manpower to meet services and industry requirements • 100% FDI allowed in the education sector • India's online education market size expected to be US$40 billion by 2017

This requires a long term vision to re-define the infra needs of India to a ground level, creating responsible groups and delegating the development at root level. Since Smart City projects require very huge funds and involve numerous stakeholders, the risk of projects not meeting the targeted standards is very high. Innovative mechanisms such as professional project management approach can reduce the risks under these programs to a great extent, reducing the inherent corruption, avoid higher costs, delays and to complete each development project with the expected standards

2 Project Management: An innovative Mechanism

According to Project Management Institute (PMI), Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. And a Project is defined as a temporary endeavor undertaken to create a unique product, service, or result.

India is determined at the present juncture, to re-establish itself at the global level and emerge as world class economy, with its concepts and themes such as "Make in India" and "Digital India". It is high time that all the growth contributors from the infrastructure sector are reviewed once again and make their shares for the redefinition of India. A professional project management approach is the only way out to overcome the barricades of growth in meeting the infrastructure targets of India. The entire portfolio of infrastructure and the various development programs under it can be perfectly fit to be projects by themselves. The infrastructure targets can be translated into independent projects to measure the achievements and make appropriate revisions.

2.1 Project Phases

A project may be divided into any number of phases. A project phase is a collection of logically related project activities that culminates in the completion of one or more deliverables.

Predictive life cycles (also known as fully plan-driven) are ones in which the project scope, and the time and cost required to deliver that scope, are determined as early in the project life cycle as practically possible. As shown in Figure 2, these projects proceed through a series of sequential or overlapping phases, with each phase generally focusing on a subset of project activities and project management processes. The work performed in each phase is usually different in nature to that in the preceding and subsequent phases, therefore, the makeup and skills required of the project team may vary from phase to phase.

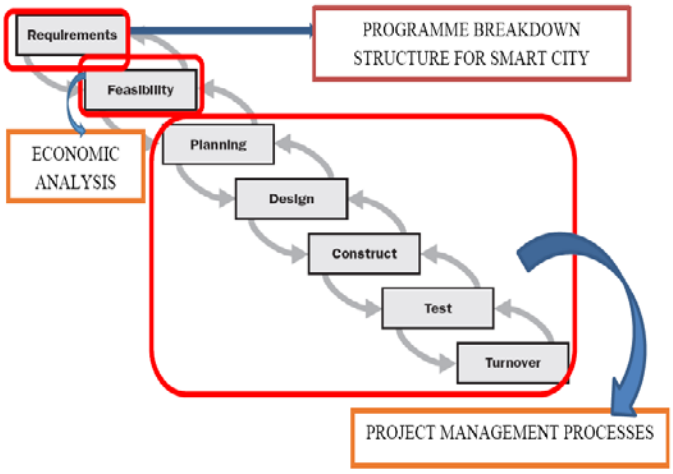

Figure 2: Project Phases

2.1.1 Programme break down structure for smart city

The smart city targets can be translated into independent projects in order to analyse each project for its economic feasibility and implement project management processed for each of independent project to measure the success of distinct project under smart city model. A schematic diagram for programme break down structure for mart city model represented in Fig. 3

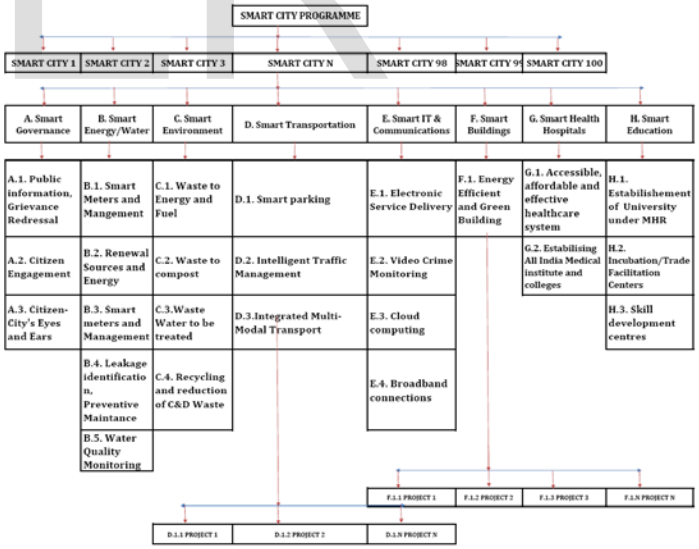

Figure-3: Programme Break down Structure for Smart City

2.1.2 FEASIBILITY: Economic Analysis in Investment

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Projects

Any investment project requires an economic analysis. The main role of economic analysis is to design and select the projects that contribute to the welfare of a region or a country. Economic analysis is most useful when used early in the project cycle, for identify bad projects and bad projects components. If economic analysis is used at the end of the project cycle, it can only help in the decision of whether or not to proceed with a project. Economic analysis differs from financial analysis which evaluate a project only from the point of view of the owner of the investment. Economic analysis includes all social and environmental costs which were not taken into account by financial analysis. Transforming the market prices used in the financial analysis into accounting prices is achieved by using conversion factors affecting corrections costs or benefits as taxes or subsidies [3].

Economic analysis is the procedure for assessing the opportunity of a project by considering the benefits compared to the costs, both elements being considered economically. The economic analysis uses the same indicators as financial analysis, but unlike it has in considering other additional aspects such as:

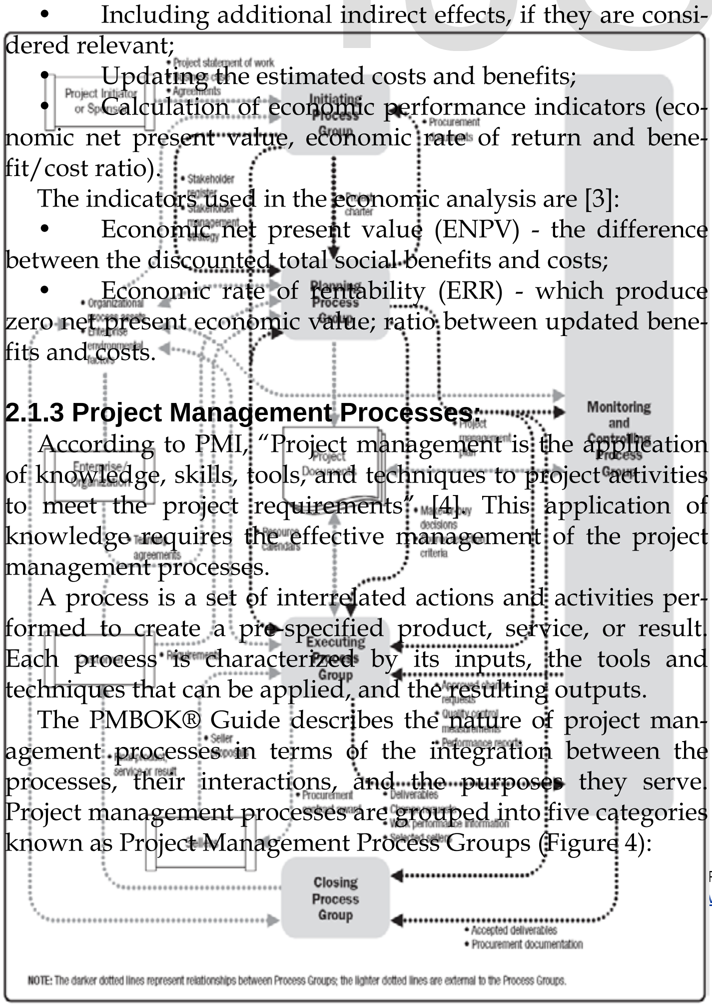
- Market influences;
- Other external factors influences;
- The social and environmental costs, etc.

According to the methodology established by the „Guide on the methodology for cost-benefit analysis” [6] of investment projects, economic analysis involves the following steps:

- Transforming the market prices into accounting prices;
- Monetization of uneconomic impacts;
- Including additional indirect effects, if they are considered relevant;
- Updating the estimated costs and benefits;
- Calculation of economic performance indicators (economic net present value, economic rate of return and benefit/cost ratio).

The indicators used in the economic analysis are [3]:

- Economic net present value (ENPV) - the difference between the discounted total social benefits and costs;
- Economic rate of rentability (ERR) - which produce zero net present economic value; ratio between updated benefits and costs.


Initiating Process Group
Planning Process Group
Executing Process Group
Monitoring and Controlling Process Group
Closing Process Group
NOTE: The darker dotted lines represent relationships between Process Groups; the lighter dotted lines are external to the Process Groups.

2.1.3 Project Management Processes:

According to PMI, “Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements” [4]. This application of knowledge requires the effective management of the project management processes.

A process is a set of interrelated actions and activities performed to create a pre-specified product, service, or result. Each process is characterized by its inputs, the tools and techniques that can be applied, and the resulting outputs.

The PMBOK® Guide describes the nature of project management processes in terms of the integration between the processes, their interactions, and the purposes they serve. Project management processes are grouped into five categories known as Project Management Process Groups (Figure 4):

I. Initiating Process Group.
II. Planning Process Group.
III. Executing Process Group.
IV. Monitoring and Controlling Process Group.
V. Closing Process Group.

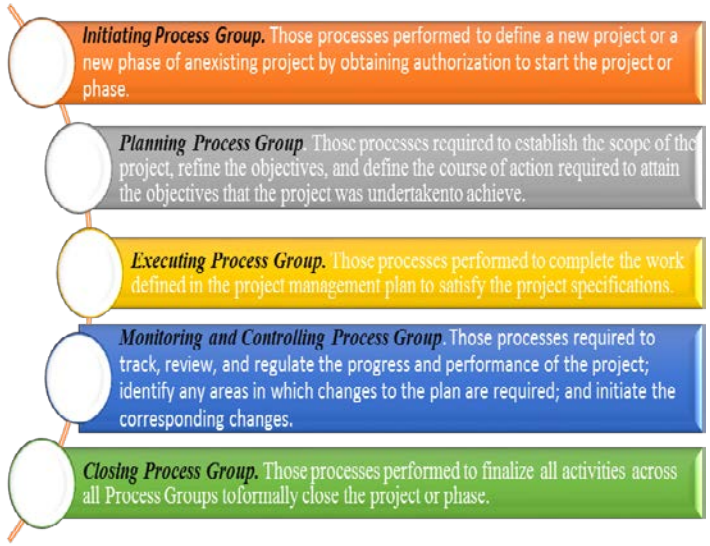
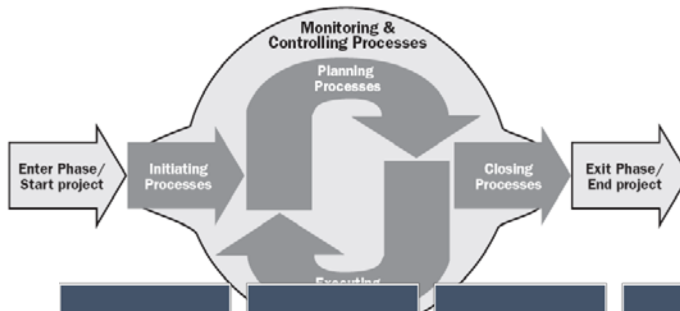
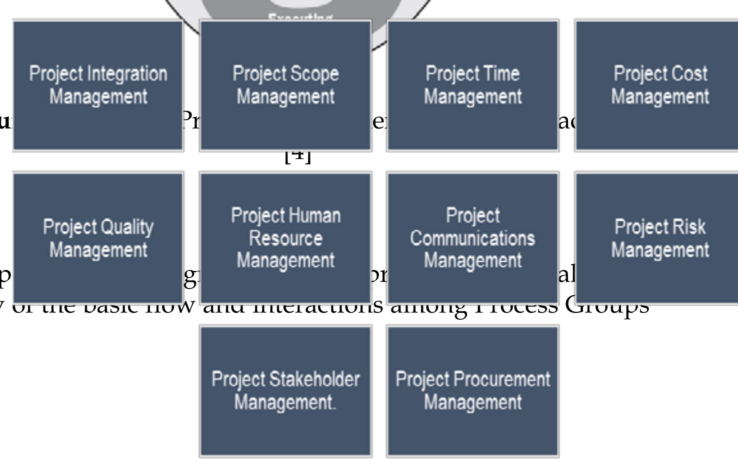

Initiating Process Group. Those processes performed to define a new project or a new phase of anexisting project by obtaining authorization to start the project or phase.
Planning Process Group Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertakento achieve.
Executing Process Group. Those processes performed to complete the work defined in the project management plan to satisfy the project specifications.
Monitoring and Controlling Process Group. Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.
Closing Process Group. Those processes performed to finalize all activities across all Process Groups toformally close the project or phase.

Figure 4: Project Management Process Groups

2.1.3.1 Common Project Management Process Interactions:

The application of the project management processes is iterative, and many processes are repeated during the project. The integrative nature of project management requires the Monitoring and Controlling Process Group to interact with the other Process Groups, as shown in Figure 5. Monitoring and Controlling processes occur at the same time as processes contained within other Process Groups.




Project Integration Management
Project Scope Management
Project Time Management
Project Cost Management
Project Quality Management
Project Human Resource Management
Project Communications Management
Project Risk Management
Project Stakeholder Management
Project Procurement Management

Figu Pr e ac
[4]

The p g or al
mary of the basic flow and interactions among Process Groups

and specific stakeholders. The project management processes are linked by specific inputs and outputs where the result or outcome of one process becomes the input to another process but not necessarily in the same Process Group.

Figure 6: Interactions among Process Groups and specific stakeholders [4]

There are almost 47 project management processes identified in the PMBOK® Guide are further grouped into ten separate Knowledge Areas. A Knowledge Area represents a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization. The knowledge areas are listed in the Fig. 7

Figure 7: PMI's Project Management Knowledge Areas

Table 2 reflects the mapping of the 47 project management processes within the 5 Project Management Process Groups and the 10 Knowledge areas.

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
Project Integration Management	1. Develop Project Charter	2. Develop Project Management Plan	3. Direct and Manage Project Work	4. Monitor and Control Project Work 5. Perform Integrated Change Control	6. Close Project or Phase
Project Scope Management		1. Plan Scope Management 2. Collect Requirements 3.Define Scope 4. Create WBS		5.Validate Scope 6. Control Scope	
Project Time Management		1. PlanSchedule Management 2. Define Activities 3. Sequence Activities 4. Estimate Activity Resources 5.Estimate Activity Durations 6. Develop Schedule		7. Control Schedule	
Project Cost Management		1. Plan Cost Management 2.EstimateCosts 3. Determine Budget		4. Control Costs	
Project Quality Management		1. Plan Quality Management	2. Perform QualityAssurance	3. Control Quality	
Project Human Resource Management		1. Plan Human Resource Management	2. Acquire Project Team 3. Develop Project Team 4. Manage Project Team		
Project Communications Management		1. Plan Communications Management	2. Manage Communications	3. Control Communications	
Project Risk Management		1. Plan Risk Management 2. Identify Risks 3. Perform Qualitative Risk Analysis 4. Perform Quantitative Risk Analysis 5. Plan Risk Responses		6. Control Risks	
Project Procurement Management		1. Plan Procurement Management	2. Conduct Procurements	.3 Control Procurements	4. Close Procurements
Project Stakeholder Management	1. Identify Stakeholders	2. Plan Stakeholder Management	3. Manage Stakeholder Engagement	4. Control Stakeholder Engagement	

Table 2: Mapping of Project Management Knowledge areas, Process Groups and Processes

3 Conclusion

Projects must be conceived, managed and operated as an integrated whole, with the prime purpose being the user and eco-

nomic benefits, rather than the completion of a physical project as Where the success of the outputs depends on operational interfaces as well as infrastructure construction, these must be managed from the outset and integrated into the programme management of the whole project.an end in itself. In this paper the smart city was approached as a unique project – instead of a project portfolio- in terms of scope, owner, client, budget, and implementation timeframe. In this context, the smart city appears to be large-scale, complex and ongoing. The project management perspective was applied on the projects, in order to define an appropriate management model for similar cases.

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