"Linked Open Apps Ecosystem to open up innovation in smart cities"

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Author:	**Raul Gonzalez (RET)**
Co-Authors:	**BCN, CDG, CIS, COBO, FRA & GLA**

Summary

This document analyses and evaluates business models open to iCity and the Cities.

DOCUMENT HISTORY

Version	Date of issue	Status	Content and changes	Modified by
0.1	06/11/2013	Draft	Creation of the deliverable	RET
0.2	20/11/2013	Draft	Outcomes from specific workshop during Smart City Expo & Congress	BCN, BOLO, GLA, CISCO, FOKUS, RET
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0.5	06/02/2014	Draft	Daft version as submitted	RET
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0.9	16/04/2014	Final	Final version was submitted	RET

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Abbreviations and Acronyms

Acronym	Description
MAN	Metropolitan Area Network
NGN	Next Generation Networks
CDB	Comune di Bologna
CDG	Comune di Genoa
GLA	Greather London Authority
API	Application Programming Interface
AGSC	Genoa Smart City Association
SLA	Service Level Agreement
IoT	Internet of Things
SiG	Special interest Groups
SME	Small & Medium Enterprise
PaaS	Platform as a Service
SaaS	Software as a Service
SiG	Special interest Groups

1. Market overview

1.1 Overall context: New rules on city infrastructure

Analysis shows there are many different social aspects, trends and cities strategies that change and shape the relationship models in cities, according to the demands of the citizens & companies. This opens up new opportunities to players and businesses as was revealed in document D7.1.

One of the aims of the new environment, is for citizens to have more interaction with the city infrastructure, from which will be created new public interest services, where the movement of people and their interaction with infrastructure (Citizens, public administration staff, SME and private Companies), will lead to a new wave of the use and management of the city infrastructure to satisfy new demand. A new city paradigm will exist where citizen 'demand' is put first ahead of infrastructure 'capacity - new rules in the market.

	Classic infrastructure management		New infrastructure management
Business model	Tested and predictable	→	New and unpredictable
Value proposition	Reliability & Infrastructure	→	Supply & service flexibility
Service distribution	Very limited for citizens or third parties, operate by the city or company instead of the city	→	Open, using "public platform" and open tools
App's	Specific, fewer and limited, basically for internal use.	→	Actually we can find more that 700K apps in different platforms adapted to specific needs.

- **App's**

  Let's focus on app's side, it means a completely new business scenario where cities need to "re-think" their approach, develop new tools, process, security, services ... but on the other hand, it means an increase of the citizens satisfaction, an explosion of services designed and developed by the users that are better suited to their needs and contribute to a more efficient use of municipal infrastructure. The city infrastructure becomes an enabler in the app's world, but at the same time, it's a loyalty mechanism improving the engagement of the citizens and companies with their cities.

  Service distribution has an impact due to app's world explosion; the actual walled gardens and classical value added services have reduced their predominant position and needs to re-adapt their offer.

Increasing number of applications hits directly on the existing value proposition of municipal infrastructure, as it represents a challenge to infrastructure "core" applications and management. Rather than competing, apps however should be viewed as complimentary to cities services models, with mission critical apps e.g. car parking, considered of strategic

value to the city and therefore to be invested in as part of addressing the wider challenge of road network congestion.

App's world facilitates three basic points:

- Sharing (infrastructures, knowledge, costs, revenues...)
- Collaboration (creativity, cities, socialization, new relationship models...)
- Synergies (optimization, efficiency, management...)

Those are the "magic" points that are transforming the actual city infrastructure business models.

- **Service distribution**

So far, infrastructures have had very few options to be opened and tools have proved limited and basically management oriented. In this new environment, where software is a common infrastructures complement, the developing of new solutions for more applications and the sharing of the said infrastructures it's easier.

The use of service deliver platforms, gateways, API managers or app's store facilitates the distribution or the access to the infrastructures and the creation of new services.

- **Value proposition**

Obviously, the new service distribution mechanism and supply increase helps to generate more flexible services and to democratize their use.

Developers become a key component in creating in partnership new services paid for by the cities (strategic apps), or the development of stand-alone apps that are more likely to be driven by advertising based commercial models.

- **Business model**

That's one of the biggest impacts. The traditional methods of business plan evaluation (NPV, DCF) fail in their estimation of such uncertain scenarios. There appears the need to evaluate the model with other parameters adapted to this new environment or find models where either the risk can be shared or kept under control.

The new scenario completely changes the actual rules in such a way that it is necessary to re-adapt the value proposition of cities infrastructures and generate a new ecosystem where the developers are the key element.

Open Data is a useful guide to what models will work in the future. The original proposition was to make data freely available to all, and available free of charge, however with the aggregation of mixed public/private/personal data there is an expectation of a value based proposition where the public sector and individual citizens will be seeking to recover costs in return for providing value to the developers apps.

1.2 New Ecosystem

This new work environment reveals the need to create an ecosystem with control mechanisms basically at service creation and distribution level.

- **Creation**

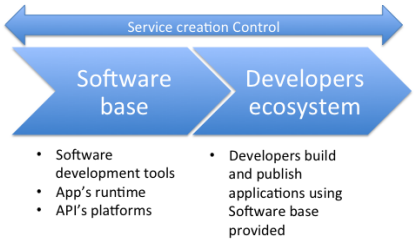


Figure 1 Creation (New Ecosystem)

- **Distribution**

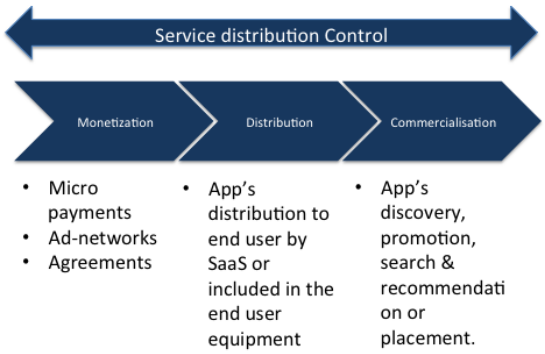
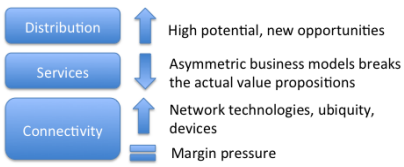


Figure 2 Distribution (New Ecosystem)

1.3 Evolution

	Today	In new environment
Economics	• High CAPEX and OPEX. • Optimized to ensure the resilience of few services with high SLA's. • Service – infrastructure models. Specific infrastructure design adapted to service.	

	Today	In new environment
Ecosystem	**COMPETITION** Competition based on proprietary platform and solutions, with very limited applications.	**ECOSYSTEM LEVERAGE** Ecosystem generation leverage on: ○ Innovation promotion. ○ Users and market diversification. ○ Loyalty. ○ Strengthen use.
Innovation focus	Innovation based on city infrastructure limited to high profile people or limited in number due to economic factor or access to the technology	Add value to the ecosystem beyond the infrastructures: ▪ Local to Global. ▪ Physic distribution (equipment) / Digital (SaaS). ▪ User acknowledges. ▪ Flexible billing models, ▪ API's.
Developers	Provider vision: ▪ Exclusivity agreements sometimes not balanced. ▪ High entry barriers. ▪ Risk transferred to developer. ▪ Strict provider selection.	• Developers become "re-sellers" with high added value. • App's becomes the showcase. • API's becomes developer's loyalty tools and user dependent app's. • Low entry barriers. • Increase the number of providers.

1.4 Value Chain

In this new scenario the value chain has an evolution.

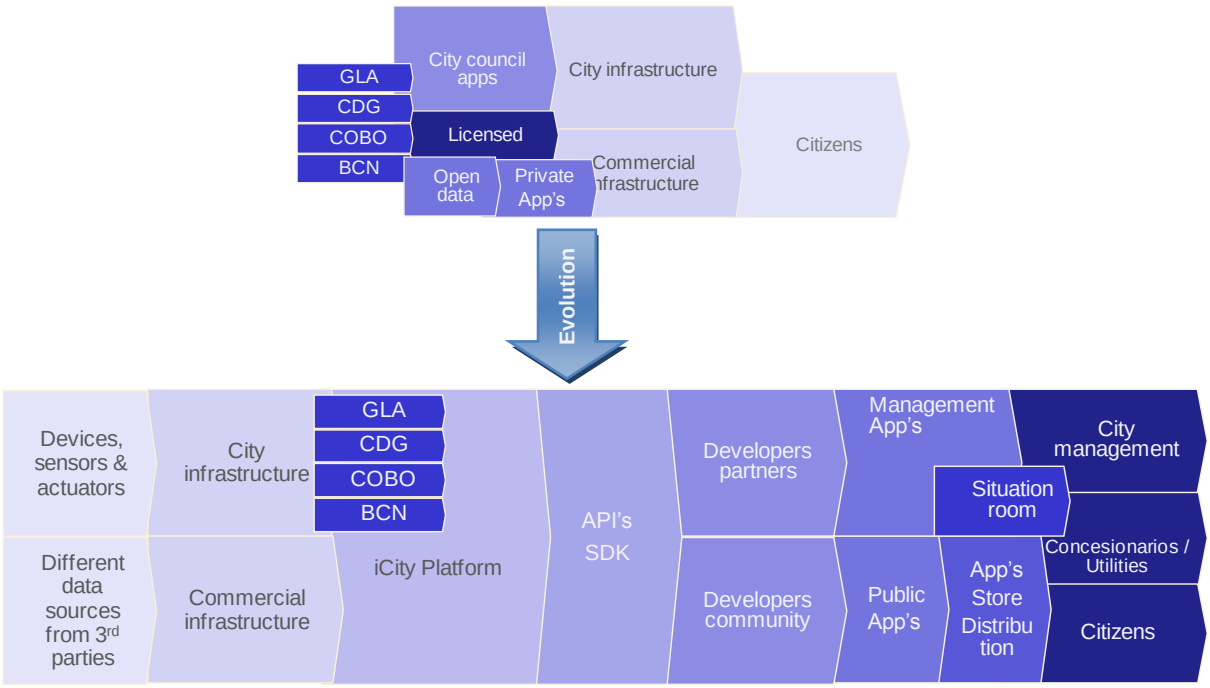
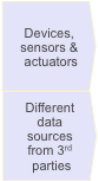
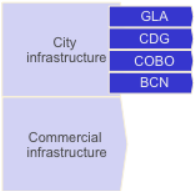


Figure 3 iCity supply 'value' chain

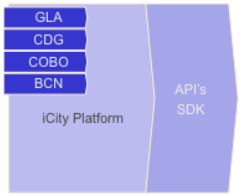
This new value chain is more flexible in opening to new business models and opportunities.



New or existing elements share access to the infrastructures in order to provide information (p.e. sensors, smart phones, data bases), or act (p.e. light). Those elements are not only from infrastructure owner, it's open to 3rt parties. The objectives are share information and actions between different players in the cities and find synergies. (Local deployment)



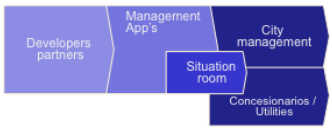
Open city infrastructure guaranty the access of devices, sensors, actuators, data from different provider (Public and private), but at the same time it make possible to combine public and commercial/private infrastructure in order to reduce the CAPEX, share OPEX or complement to guaranty the coverage of the services. This heterogeneous infrastructure could be described as the smart urban infrastructure. (Local deployment)



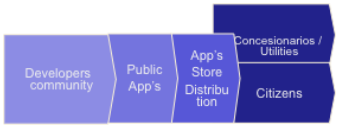
The next step in the value chain is iCity platform; it's a common element, shared by different city members. It's part of what we have called "service distribution" and facilitates the access to infrastructures, the control of creation and use. It's the key steps in this new value chain. Homogenized access to the infrastructure of cities and has control on how the different users (public administration, developers, private companies, citizens) access it.

At this point of the value chain, we can have to different kinds of users:

- “Public services” providers



- Citizen’s app’s providers



The difference between them is that Public service providers deploy and manage the city service catalogue and citizen’s app’s providers could develop services for public interest using the iCity platform facilities.

This raises the question whether to isolate the devices infrastructure and data from service creation, which would make easier the deployment of new services, sharing data/api elements and obtaining synergies.

2 iCity Platform business model

2.1 Introduction

During the last quarter of 2013 we have conducted several workshops designed to have a base where evaluate and build the iCity business model. It has served to align views, reflect and agree on some basic elements to take into account. It is therefore, a starting point for how we see iCity from iCity members, this should allow us to analyze the market more clearly and identify:

- Entry barriers
- Competitors
- Suppliers
- Substitutes
- And users / customers

Define future scenarios and strategies.

Canvas describes the business models by the division in 9 basic modules that reflect the way to generate revenues in any kind of business. The 9 modules cover the 4 principal areas of any business:

- Customers
- Offer
- Infrastructure
- Economic viability

To analyze the business model we have to:

- **Identify the Target**

  To identify the target it is necessary to classify groups of developers, to classify infrastructure category and to classify types of city.

- **Identify the type of cost**

  Analyze the cost classifying the type in CAPEX or OPEX.

- **Assumptions revenue streams**

  Perform hypothesis about all income to verify that the model is sustainable.

2.2 Customer segment analysis.

We have identify three different customer segments related with the value chain

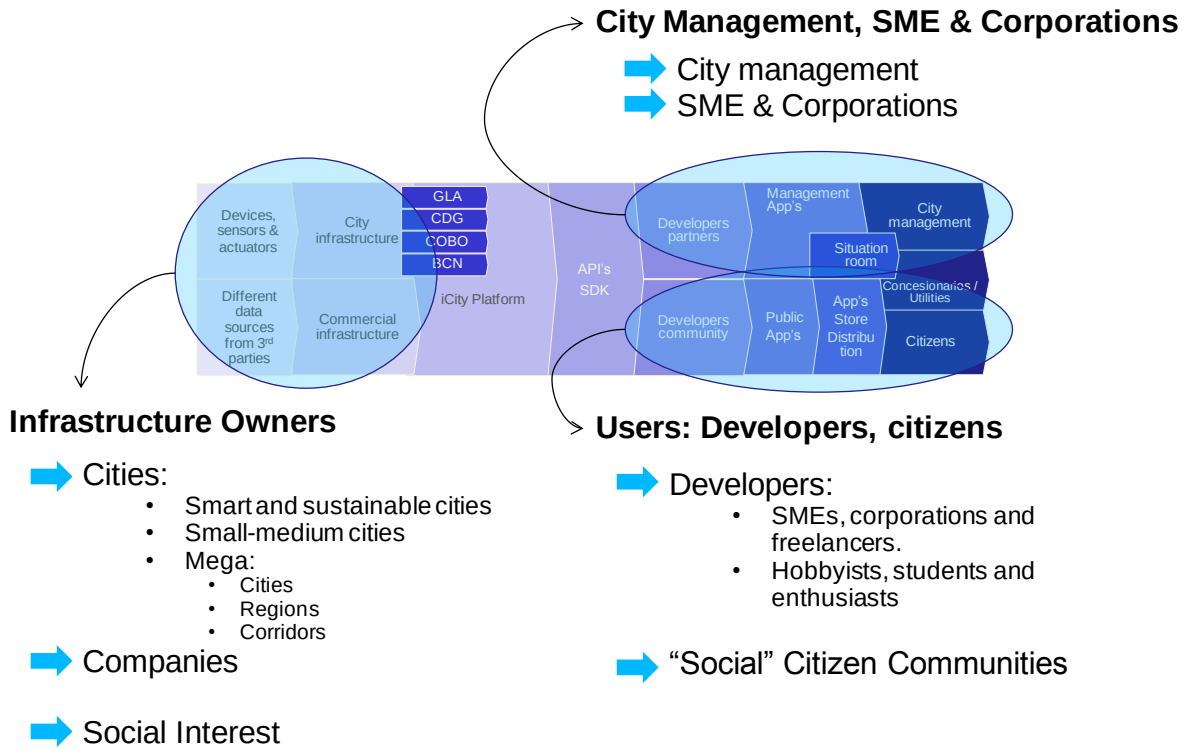


Figure 4: Customer segments

2.2.1 Infrastructure Owners

This chapter aims at describing the business model for the particular case where the target is infrastructures providers, either Cities or Companies. The following graphic shows the supply chain value for this case, under which the correspondent business model will be analyzed:

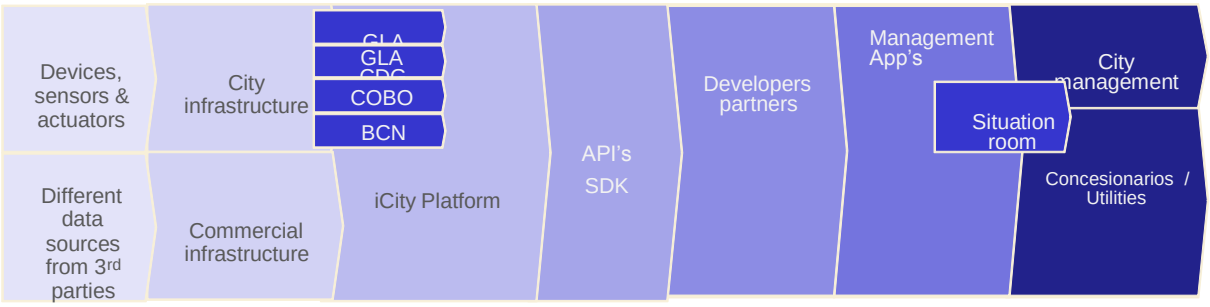


Figure 5 Infrastructure owner supply 'value' chain

As described above, two different customer segments are considered in this category: cities and companies:

Cities

In terms of demography, GDP contribution and geography, cities can be classified as:

- Smart and sustainable cities: Much interconnected cities, with intelligent infrastructures and technologically efficient.
- Small-medium cities: cities with less than 2 million people.
- Mega cities: urban cities of more than 2 millions or with a great impact in national GDP.
- Mega regions: conglomeration of cities with more than 3 millions or great impact in national GDP.
- Mega corridors: connect to Mega cities or corridors with a combination of more than 10 millions of population; their impact in national GDP is very high.
- iCity provides a platform flexible enough to be adapted to all the above city configurations. The analysis further on is therefore valid for a wide range of cities, regions, or corridors.

Companies

A natural stakeholder to which iCity can be addressed is those companies with infrastructures of their own:

- iCity offers a path to complement the companies' products and/services and make them more attractive by giving access to open infrastructures.
- iCity provides new mechanisms to add to the revenues that can be derived from the sensor assets within the infrastructures.
- iCity allows companies to share their infrastructures with those belonging to the Cities.

  From the perspective of their ownership, infrastructures can be more specifically classified as public, private or PPP based – each of these may cover utilities such as:

  - Electricity;
  - Gas;
  - Water;
  - Sewage;
  - Telecomms e.g. Broadband.

Social Interest

From their social interest, infrastructures can be of:

- Private Ownership Commercial purpose: private transport, private telecom networks, ...
- Public Ownership Social purpose: police, healthcare and sanitation equipment, fire-fighting systems, public transport...

Within these infrastructures can be grouped into the following categories:

- Sensors: a device measuring physical parameters and capable of being controlled through a down loop.
- Access Devices: any physical device other than sensors (e.g. tablets, smart phones, etc).
- Communications: data running over the physical infrastructure.
- I.S. (Information Systems): Software platform.
- Data

Which infrastructures will be opened by the rest of sub segments considered above (cities, companies, ownership modalities, social interests) is shown in the following table:

	Sensors	Devices	Communications	I.S.	Data
Cities	X	X	X	X	X
Private/Companies	X	X	-	X	X
Social Interest	X	X	-	-	-

Table 1 Infrastructure Category

2.2.1.2 Value proposition

The following lines introduce the advantages that justify the adoption of iCity as smart platform for a city or company, by taking into account the public interest and the possibility of getting revenues in return:

- **Common services**: iCity allows the development of services of public interest. These services can be easily readapted to be used in other cities under the platform, thus maximizing synergies between them.
- **Open public infrastructure + data**: It allows the use of the cities' information systems and aggregation of content, thus getting benefits or revenues out of existing public infrastructures.
- **iCity as a Broker or neutral point**: By opening its infrastructures, and working with third parties each city can collectively benefit from shared data, thus contributing to a positive impact on design and operation of the cities.
- **System Management tools & security**: iCity allows the responsible of the city or company information systems that determines and defines the policy of use of the

correspondent infrastructure, thus controlling how they will be accessed. For each particular case, it will be the iCity platform that will implement these requirements. Moreover, the platform isolates the different entities' infrastructures from each other, thus preventing them from any interference.

2.2.1.3 Scheme value proposition

The next picture shows the value proposition canvas in connection with Customer Segment:

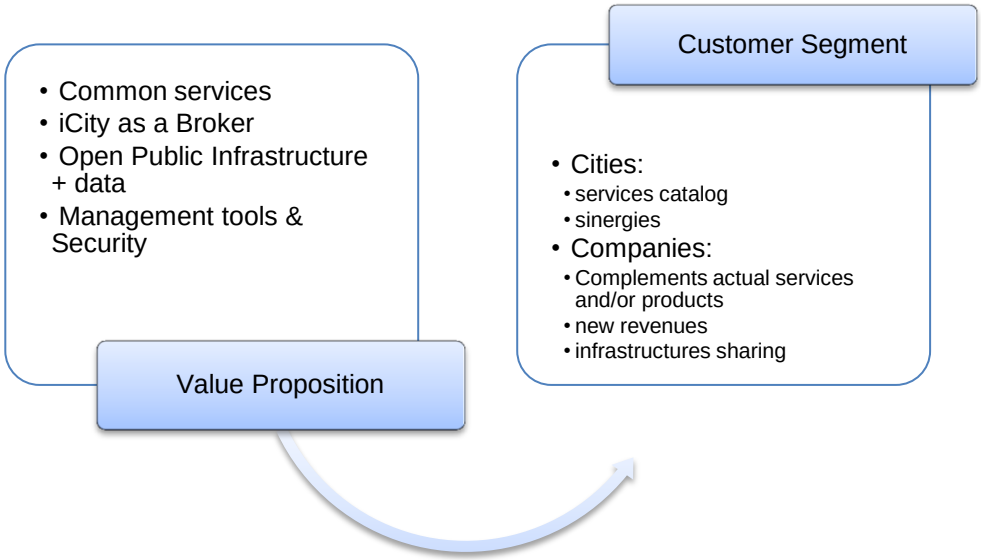


Figure 6 Value proposition for infrastructure owners

2.2.2 Users: Developers & Citizens.

This chapter aims at describing the business model for the particular case where the customers are users (developers and citizens)

This model goes along this section of the value chain:

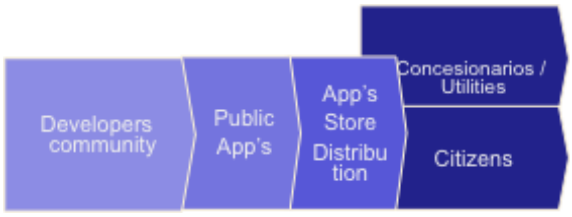


Figure 7 User: Developers & Citizens value chain

2.2.2.1 Customer segments

In this segment, we distinguish two different customer segments:

Software Developers

We define developers in this business model as SMEs, Systems Integrators e.g. corporations, freelancers, hobbyists, students or enthusiasts that make use of the iCity platform services to develop open source or proprietary software applications:

- **SMEs, corporations and freelancers:** mainly generate value business value by developing applications either to sell or generate revenue through advertising; **Hobbyists, students and enthusiasts:** mainly generate value through knowledge and the creation of code synergies for others to follow

Developers provide feedback to the developer's community and add applications to the application store 'app store' (see deliverable 5.1 for details).

Citizens

Citizens are the final customers of the iCity platform. They access applications from the 'app store' and will fall into two categories:

- **"Social" Citizen Communities**: that is to say, citizen communities sharing specific challenges, priorities or social features. In many cases the challenges are ignored or serviced through human interaction. iCity provides a platform on which to build tools to address any social or community challenge.

2.2.2.2 Value proposition

For cities management:

- **Cost reduction** in the generation of new services and applications (more value for the citizens), with little or no intervention from the city administration.

For developers:

- iCity platform provides an **open, standard and homogeneous API** that decouples applications from the underlying complexities of the city infrastructures, data and services.
- iCity allows the **inclusion** of elements that can interact with the city's infrastructure.
- **Return of investment**: The iCity API allows an application (or some of its components) to be city agnostic. This way, an application developed in Bologna may be usable in other cities, with little or no change.
- The application certification process guarantees the quality and security of the applications and enhances their visibility in the software industry.

For citizens:

- The **application certification process guarantees** that the application comes from a reliable source and can be trusted.
- Provide tools to create and customize services according their specific needs, of special interest for communities.
- Increase city user experience: **Digital city services** for the digital citizen.

2.2.2.3 Scheme value proposition

The next picture shows the value proposition canvas in connection with Customer Segment:

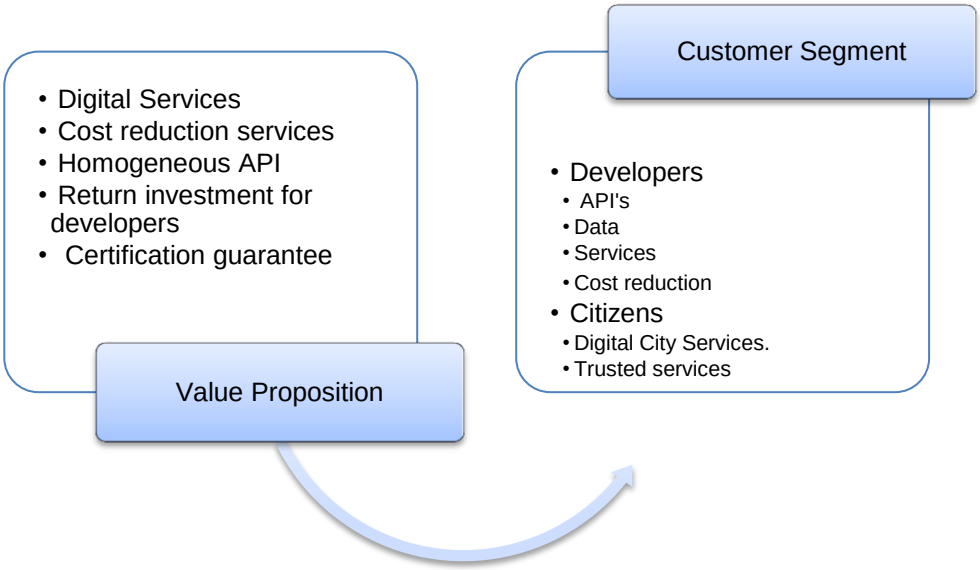


Figure 8 Value proposition for users (Developers & Citizens)

2.2.3 City Management, SME and Corporations

This section aims at describing the business model for the particular case where the customers are the City management SME and Corporations.

We have SMEs and companies that deploy and manage the city service catalogue:

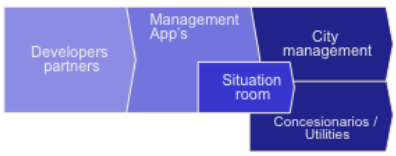


Figure 9 Value chain for City management, SME and Corporations

2.2.3.1 Customer segments

The following characteristics have been identified with regard to:

City mMnagement

- Developer partners of the iCity platform.
- Provide ideas and requirements for service development by the developer.
- Set out and establish security policies and legal requirements.
- Provide city services and management to citizens
- Cities or any other Public Administration (PA) willing to access other cities' data or services, e.g. cities sharing transport links or communication hubs, etc. This will facilitate the transition from the Smart City concept to Smart Area or Smart Region.

SMEs and Corporations.

- Developer partners of the iCity platform
- Provider of management applications and/or services to the Cities and Citizens
- Providers of public city services (private or PPP utilities) such as electricity, gas, water, sewage and sometimes communications.

2.2.3.2 Value proposition

The iCity platform provides a branded, secured and standards based single point of integration for public infrastructure and service providers.

- **Cost reduction** new services and applications with less OPEX/CAPEX from the city administration. Combined public and private infrastructures reduce the CAPEX, share the OPEX or complement each other to guarantee the coverage of the services.
- **Cooperation or co-creation** of services from multiple vendors results in more homogeneous, interoperable and easy to maintain solutions. Example: Vendor A provides the infrastructure while Vendor B provides the App.
- Development of services that make use of **multiple infrastructures** from different organizations outside the city.
- **Return of investment**: Any service provided by a company may be city agnostic. This way, the knowledge, experience and artifacts generated after deploying a service or infrastructure in a city may be easily reuse for other cities.
- Third-party applications built on top of integrated infrastructures and services **add value** to the original vendor proposal
- **Decoupling** applications and services from the underlying complexities of the infrastructures allows them to have separate life-cycles. Example: An infrastructure may be upgraded without affecting any of the services that are built on top of it.

- **Centralized auditing** of services and infrastructures: availability, stats, event notification and other mechanisms that provide each party ways to monitor the usage that is being given to their systems
- **Centralized catalog** of all open infrastructure and services
- The platform is **non-intrusive** and requires **no changes to the underlying IT** systems of the different organizations.
- Legal liability is between the owner of the infrastructure and the developer/user of the sensor/data – Cities are removed from all obligations.

2.2.3.3 Scheme value proposition

The next picture shows the value proposition canvas in connection with Customer Segment:

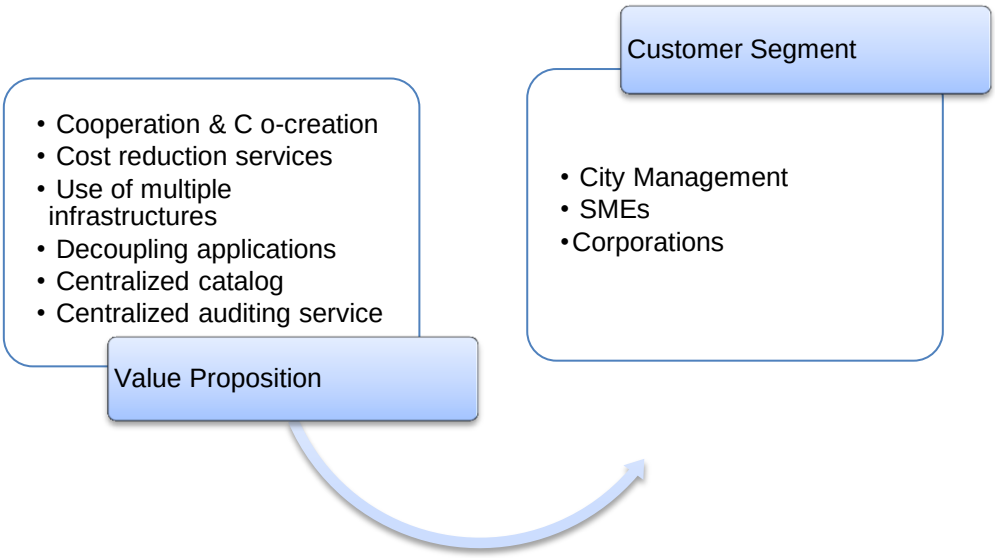


Figure 10 Value proposition for City Management, SME & Corporations

2.3 Revenue Side

As with any P&L there is revenue and costs to be considered in arriving at the commercial viability of the platform – the costs are further explored in section 2.4 and D. 7.3.

2.3.1 Customer relationships

iCity must define what kind of relationship it wants established with each of the identified market segments. These relationships will be based on the capture of user and customer data during each transaction or session:

- **Common APIs**. The common programming interface provides the developers with a solid backend for their applications and enhances their relationship with the community **A self-service relationship**, using the iCity platform site, forums, blogs and community sites is adequate for companies and partners that provide services that make use of infrastructures and services already integrated into the platform. For example, **a consulting firm may capt**ure data from the open platform and perform advanced analytics to create products like social or marketing studies.
- **A more complex relationship**, like dedicated personal assistance and co-creation with city authorities is required for SMEs and corporate that integrates any relevant public service or infrastructure into the platform.
- **Engagement events**: Additional relationships are built during engagement events.
- **Platform, data analytics** or specific application and tools for the enterprise user.
- **Relationships with developers** are established and maintain through the developer's community: web portal, forums, blogs, issue tracker and social sites.
- **Development of new versions of the API**, follows a clear, well-defined roadmap, uses feedback from developers and tries to maintain backwards compatibility when possible.
- **Multiple versions of the API** may be deployed simultaneously, giving time to developers to adopt the newest versions.
- **The application certification** procedure must warn the developer when deprecated functionality is accessed or detect common errors that affect performance, especially those that make CPU/memory expensive calls to the API and give guidance on how to avoid these issues.
- **Documentation** includes new features, upgrade recommendations, breaking changes and examples.
- **Relationship with citizens** is self-serviced oriented and established through iCity web portals, support forums and social and community sites. Application technical support is provided by developers, but purchase support is provided in the app store.
- **Management tools & Security**: Cities and companies will interact with the platform through management tools provided by the platform itself. These interactions are to be performed under security rules that assure the compliance with the different security policies defined by the different information systems responsible.

	Owners	Users	SME[1]
Common APIs	X	X	X
Self service relationship		X	X
More complex relationship	X		X
Engagement events		X	
Platform, data analytics	X		X
Relationships with developers		X	
Development of new versions of the API		X	X
Multiple versions of the API		X	X
The application certification	X	X	X
Documentation	X	X	X
Relationship with citizens		X	
Management tools & Security	X		X

Table 2 Customer relationships

2.3.2 Channels

It is the way in which iCity communicates with the market segments identified for the purpose of carrying out their value proposition.

Phase		**Channel**
Awareness	Common	City official bulletins News, ads Other European projects (CitySDK).
	SME / Owners	City labs iCity members Partners Channel
	Citizens / Users Developers	Developer's community initiatives (app contests, social…) Developer's events
Evaluation	SME / Owners Partners	Platform auditing tools (web site, reports…)
	Citizens / Users Developers	Feedback on the app stores, social sites, web sites or developer's community site Surveys

[1] SME, Companies and City management

Purchase	SME / Owners Partners	Agreement with consortium and city officials
	Citizens / Users Developers	App store[2] Application certification procedure[3]
Delivery	SME / Owners Partners	iCity platform infrastructure integration services iCity platform API
	Citizens / Users Developers	App stores Pre installation of apps in equipment firmware (ex: mobile phones, connected cars) Development portal
After sales	SME / Owners Partners	As indicated by service agreement
	Citizens / Users Developers	App store's support Web site support (support form and/or contact email) Call center

Table 3 Channels by market segment

2.3.3 Revenue Streams

The figures below describe the types of income sources and revenue streams have been identified and the customer segment they are referring to:

- **Engagement activities**: a Partner could promote these activities or events by directly pay an amount of money or indirectly through kind of services in exchange.
- **Sponsoring:** by mean of a general cooperation agreement with a partner. Companies which offer a facilities or support collaboration to iCity.
- **Annual fees**: coming from *Security & Management services*. These charges would apply for Infrastructures owners -cities and/or companies- but could also apply for Partners and SME.

Further analysis of the model and opportunities could provide more revenue streams based on API usage, infrastructure integration.

Infrastructure integration: Different infrastructures like sensors, devices, communications, Information systems or Data will have to be integrated in iCity infrastructure, and this point will generate an income

[2] The Apps Store is described in more detail at D5.1 – iCity Apps Store

[3] Application certification is described at D5.2 – MoU, rules and conditions.

When considering the Users' segment, revenues are thought to be:

- **Application store purchases.**
- **Application certification fees.**
- **Learning courses**
- **Developer events.**

The following table shows the relationships between customers and revenue streams:

	Owners	Users	SME[4]
Engagement activities	X		
Sponsoring			X
Annual fees	X	X	X
Application store purchases		X	X
Application certification fees		X	X
Learning courses	X	-	X
Developer events	X		
Infrastructure integration	X		

Table 4 Revenue Streams by market segment

[4] SME, Companies and City management

2.4 Cost Side

2.4.1 Key activities

These are the most important activities the iCity project must undertake to provide a successful service. It is important to note that most of these activities are common across every customer's segment, they underpin value propositions across the entire spectrum of customer's::

- **Promotion** (related to WP8 - Dissemination) is all the set of activities needed to reach iCity customers. Communication strategy is separated in five blocks: Platform, Cities and Infrastructures, Disseminate developed apps, Institutions and developers and finally citizens + services + institutions. The most important tools are: Website, Newsletter, Mass Media, Social Networks, Sector events and supporting materials like custom leaflets. Finally will be necessary to monitor all the promotion process.

- **Strategy** is important because the resources available to achieve the stated goals are usually limited. Strategic Plan and evolution: an annual meeting is expected by consortium members in order to agree the strategic actions.

- **Platform continuous development**: Required by any software solution, includes subtasks like requirement's analysis, design, development coding, testing, preproduction/development environments, upgrade plans and more. We consider a new version of platform each 12 months, anyway will be monthly improvements.

- **Platform integration for the enterprise**: Provides seamless integration to partners, SMEs and corporate into the platform to accommodate specific, negotiated requirements or infrastructures Ad hoc in terms of commercial activity.

- **Platform O&M (Operation and Maintenance) activities**: Includes subtasks like issue tracking, backups, catalogue maintenance and more. These activities ensure the platform is highly available, services are available on a 24/7 basis and their contents are up to date. External or internal cost. The service can be provided by a third party or partner or can be assumed by the infrastructure owner.

- **Platform Quality Assurance**: Activities related to ensure that the platform is compliant with standards and meets rigorous criteria on distinct features like accessibility, presentation style, availability, performance, documentation, coding and security, data protection and legal compliance. External cost. The service can be provided by a third party or partner

- **Governance & community management** are all the activities required to coordinate efforts with the platform development, from special interest groups, communities, enterprises, city authorities or any other stakeholder to avoid previous failures and ensure that knowledge and experiences are properly shared and reuse

    - **Application certification procedures** are the specific activities in this area that apply to the certification process of applications and are targeted to developers Internal cost. These activities have to be controlled by the owner of the infrastructure.

    - **Methodology implementation** are activities related to the expansion of the platform to new cities, new developers and, in general, new customers. The objective of these activities is to ease the incorporation of new customers by means of guidelines, examples, standards involved, legal considerations or any other relevant aid.

- **Training courses and materials** for developers (common API), partners, SMEs and corporate (integration and/or common API) Cost are associated with the generation of content, hosting and e-learning platform.

- **Partner engagement** comprises activities related to the involvement of partners and the synergies required to move towards collaborative *win-to-win* scenarios. Partners function is to push.

- **Financial and legal management**, independently from the chosen exploitation model, since there needs to be control on cash flows from costs and revenues and compliance with global and local legislation. The financial and legal management can be internal or outsourcing.

- **Technical support** for developer's and integrators. External or internal cost. The technical support can be provided by a third party or partner or can be assumed by the infrastructure owner.

- **Marketing and sales** engagements to integrate other cities or new infrastructures. The cost of this service may be shared between partners or by dedicated staff.

Assumptions:

- Because of the innovative nature of this project, **promotion** will place special emphasis on Cities success stories since these will clearly show how the iCity platform functions and generates value to customers.

- Platform development, enterprise integration, O&M and quality assurance activities would benefit a lot from the collaboration with partners, SMEs, corporations and the development community. To put this assumption into perspective, the execution of these activities require experience in the following areas: web portals, web services, industrial communication protocols, cloud computing, big data, analytics, accessibility, security… just to name a few.

- Technical support may involve partnership with ITIL-compliant service desks, call centres and different levels of support depending on the customer.

2.4.2 Key resources

Key resources are those elements that allow iCity to create and offer value to reach users, establish relationships with different market segments and identify sources of income. These resources could be physical, human, intellectual, and financial.

Physical resources include:

- **Private IT infrastructure** to accommodate development, testing and preproduction environments
- **Cloud platform**, including communications, O&M, web sites and services and any other production resources. PaaS is a service model based on cloud computing. In this model, iCity creates the software using tools, documentation and software libraries supplied by the cloud platform provider. iCity also controls software deployment and configuration settings. The cloud platform provides the networks, servers, storage, vitual versions for local city administration and ownership, and other services that are required to host the applications.
- **Engagement events** are a marketing activities that directly engages with consumers and invites and encourages them to participate in the evolution of the iCity brand. Rather than looking at consumers as passive receivers of messages, engagement marketers believe that consumers should be actively involved in the production and co-creation of marketing programs, developing a relationship with the brand
- **City labs** activities

Human resources include:

- **Product Management** are all the resources needed to guide planning, forecasting, or marketing of the iCity platform at all stages of its lifecycle.
- **Development, testing and quality assurance**, even if they are outsourced, since at least some project leadership, validation and coordination must be done from iCity to execute activities related to platform development, integration and quality assurance.
- **Commitment**, to ensure that all parties involved are motivated, comply with expected deadlines, remove barriers and create synergies between them.
- **Administration and legal**, for the financial and legal management
- For partners, the **city's engagement** is the most important key resource. The city has to be involved in the service. Services should not be offered in an isolated way, the city has to accommodate the service globally considering all stakeholders.

Intellectual resources include:

- **Branding**, provided by the reputation of the iCity project. Differentiation is becoming increasingly difficult, as the quality and cost of products are similar. Therefore, the key is in the business 'branding', i.e. the power of the brand as a differentiator.

2.4.3 Key partnerships

It is important to have a set of alliances that optimize the business model, reduce risk or increase the number of infrastructures or cities.

Strategic alliances with:

- **Infrastructures Owners**
- **iCity members**, needless to say, this is the heart of the project.
- **National governments and EU**, beyond financial involvement, provide great dissemination channels and collaboration from the cities.
- **Cities initiatives or other EU projects** (i.e. City Protocol, RECI, CitySDK), to share knowledge and integrate new standards into the platform.
- **Partners, Sponsors and Organizations** (Governmental or Non Governmental) which offer a facilities or support collaboration to iCity.

Joint ventures with:

- **SMEs and corporations**, as indicated by the key activities, the project requires expertise and collaboration in many areas. For SMEs and corporations, it opens a lot of new opportunities.
- **Citizens, freelancers and academics**, for they have limited resources as individuals, but are a powerful moving force as a group. The platform benefits a lot from the collaboration of individuals that, at the same time, use the platform as a solid base for their innovative products and ideas.
- **OEMs** to include iCity-aware applications on mobile phones, connected cars or any other relevant embedded device. These ventures help disseminate the platform while providing OEMs with helpful features and additional content for their devices.

Buyer-supplier relationships with:

- **Cloud platform providers** (for cloud-based business model), to ensure a compromise with the platform and be cost-effective.
- **Consulting and solution providers** (software development, quality and testing), to ensure a rapid and cost-effective development of features and solid quality and testing of the platform.
- **Consultant & Outsourcing**: For maintenance and operation services, marketing and sales services, Platform Quality Assurance, for Financial and legal management, for Technical support in general.

2.4.4 Cost structure

We have identified some of the major costs incurred to operate the business model. Depending on the exploitation plan the cost structure could be different (this is deeper evaluated in document D7.3):

- **Cloud services,** if the platform is installed in the cloud. If not, the cost of the IT infrastructure for the production environment.
- **Platform continuous development**: Including the IT infrastructures for development and testing of the software solution.
- **Platform integration for the enterprise**: iCity is a non-intrusive environment. This means that when it is adopted by a new organisation, no internal information systems of the later need to be changed. Therefore, any integration costs are to be considered on the platform's side. Additionally, every time a new infrastructure is integrated, there will be a cost derived from:
    - Development or configuration of communication protocols towards the infrastructure
    - Configuration of those infrastructure items inside the platform (e.g. sensors data structure)
    - Servicing of the new infrastructure through the API
- **Platform O&M (Operation and Maintenance)**: costs derived from O&M activities, license fees, security ... This cost will have a different impact depending on whether the platform is installed locally in customer premises or in the cloud.
- **Platform support**: Offering the platform to third parties for them to develop services will need a basic support infrastructure.
- **Quality assurance planning and execution** are all the costs associated with quality related activities. **Community management**: this cost will only be considered when the exploitation model foresees in a non-profit organisation where an iCity Community is responsible for establishing guidelines.
- **Marketing and sales, public relations, dissemination**: engagement events, etc.
- **Basic structure, administration and legal**: general and administrative costs needed to support the daily and regular operation.
- **Training courses and materials** costs may be reduced if some of these artefacts, like software reference and API documentation are included
- **Human resources** related costs**.**

Assumptions:

- Costs related to **quality and testing** greatly reduce the costs of **development and integration** activities if they are applied consistently during the development cycle. The later these activities are applied, the later the issues are detected and the higher

the cost to solve them. Also, it is important to note that, reducing the costs of software development, not only reduces the quality of the final product, but also increases the maintenance costs[5].

- The costs of generating content for the **platform support and training** can be mitigated if these artefacts are generated along the development cycle. For example: generation of reference and API documentation during development analysis, design and code phases and proper use of a continuous integration solution.

The following table further classifies costs between capital and operational expenditures, allocating activities as needed:

Cost	**CAPEX**	**OPEX**
Cloud services	Infrastructure setup	Usage fees (cloud) or maintenance (on premises)
Platform continuous development	Development of new features	Bug tracking, performance and minor changes
Platform integration for the enterprise		Development, configuration and servicing
Platform O&M		All activities, different cost on premises or outsourced
Platform support	Development and setup of support services	Support activities
Quality assurance planning and execution		Most activities related to this issue are normally outsourced
Marketing and sales, public relations and dissemination	Only initial activities	Regular activities after launch
Basic structure, administration, human resources and legal		Two different options, shared between project members or Outsourced
Training courses and materials	Only initial activities	Regular activities after launch

Table 5 CAPEX and OPEX classification

[5] "Frequently Forgotten Fundamental Facts about Software Engineering" by Robert L. Glass, (IEEE Software May/June 2001) states that maintenance typically consumes 60% average of software costs.

2.5 Canvas Model

Figure 11 iCity Canvas model

In the previous figure we can see the Canvas Model where are specified de 3 Customer Segments previously studied, each other related to its Value Proposition with the same colour.

In the Revenue side it can be observed the Customer Relationship and the Channels to get Revenue Streams.

In the cost side, through the analysis of different modules it concludes that costs are common.

All modules have been previously analyzed.

The colour code we use to design this canvas is:

Violet:	Infrastructure owners	Orange:	Users (Developers & Citizens)
Blue:	City management, SME, Corporation		
Yellow:	Common		
Green:	for SME and Owners		
Pink:	for SME and Users		

2.6 First approach iCIty Business Model

2.6.1 Revenue Stream

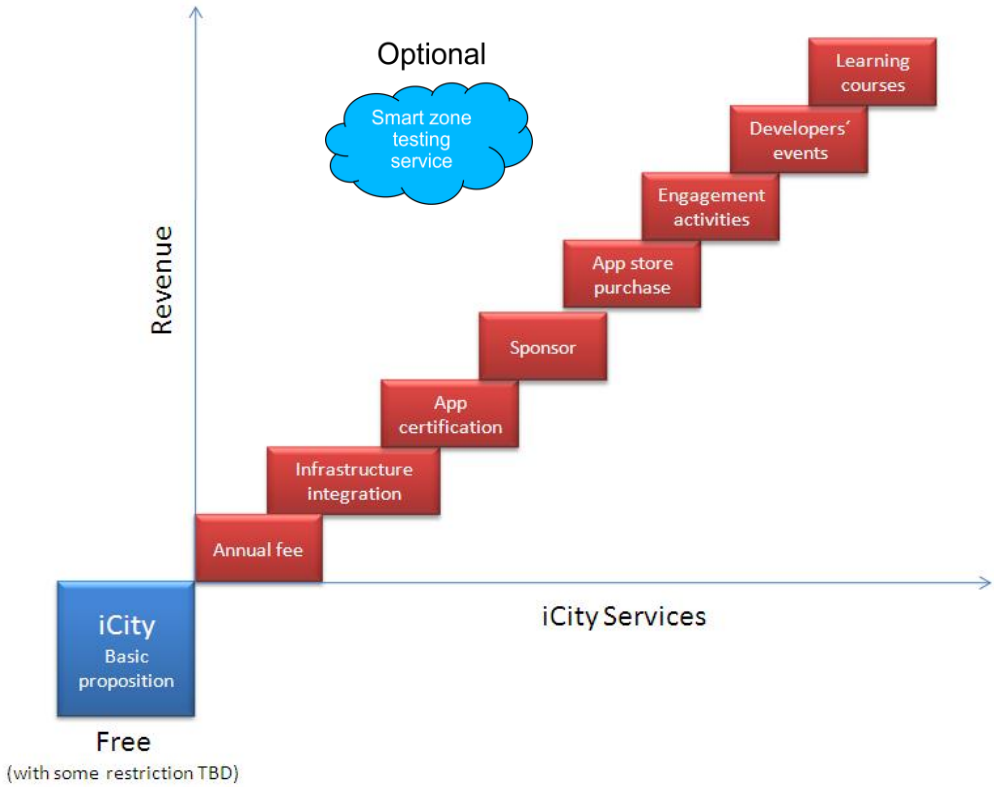


Figure 12 Revenue Stream model

This figure shows the relationship between the iCity Services and Revenues. A first layer of the Service may be free with some restrictions, and then we have the different Services which generate a direct income to the business.

There is another optional service to generate revenues which is the testing service in the SmartZone.

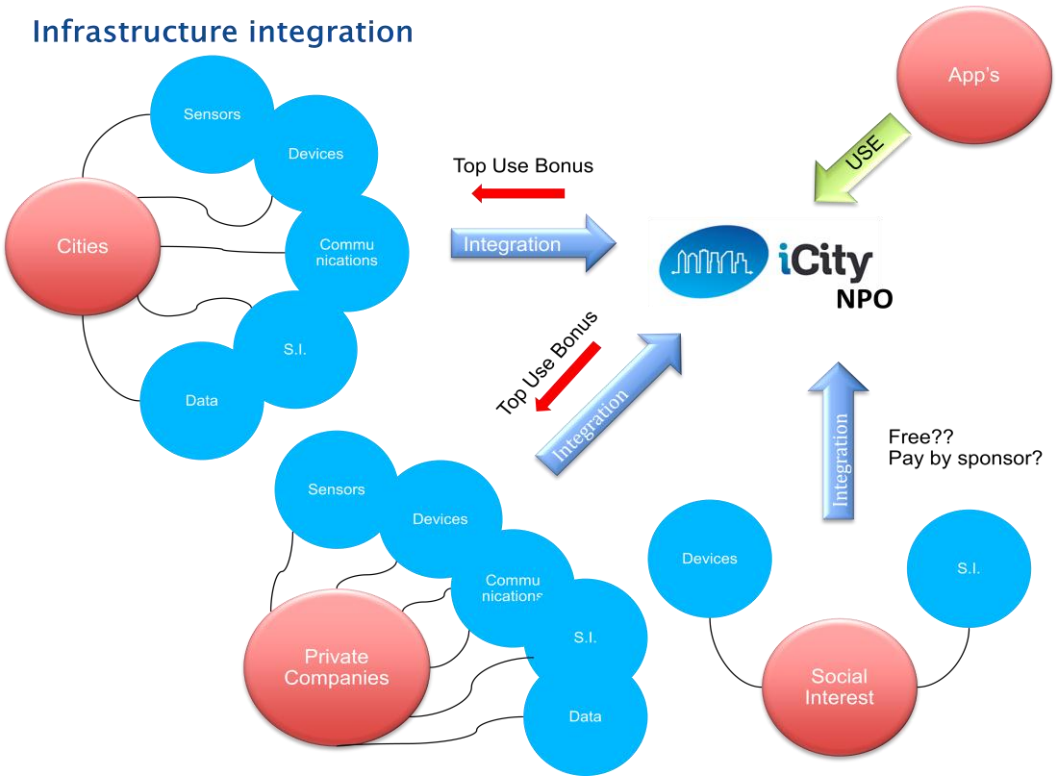


Figure 13 Revenue Stream infrastructure integration

This figure shows what the relationship in the infrastructure integration is. The customer can use the Bonus concept to “play” with iCity.

Then we have made assumptions with different services that we can see below:

2.6.1.1 Infrastructure integration

Customer					One Shot		Annually	
Segment	**Sub Segment**	**Infrastructure Type**	**# Customers**	**Average # infrastructure**	**Average Price**	**Rev**	**% Rev**	**Rev**
Infrastructure Owners	**Cities**					**550.000 €**		**27.500 €**
		Sensors	3	2	15.000 €	90.000 €	5%	4.500 €
		Devices	2	1	10.000 €	20.000 €	5%	1.000 €
		Communications	4	1	15.000 €	60.000 €	5%	3.000 €
		I.S.	4	3	15.000 €	180.000 €	5%	9.000 €
		Data	4	5	10.000 €	200.000 €	5%	10.000 €
	Companies					**360.000 €**		**25.200 €**
		Sensors	4	1	15.000 €	60.000 €	7%	4.200 €
		Devices	4	1	10.000 €	40.000 €	7%	2.800 €
		I.S.	4	3	15.000 €	180.000 €	7%	12.600 €
		Data	4	2	10.000 €	80.000 €	7%	5.600 €
	Social Interest					**28.000 €**		**1.960 €**
		Sensors	2	1	6.000 €	12.000 €	7%	840 €
		Devices	2	1	8.000 €	16.000 €	7%	1.120 €

Table 6 Infrastructure integration revenue stream

Different hypotheses to generate incomes based on new infrastructure integration, depending on the sub segment of the customer. The revenue is obtained based on the number of customers and the number of infrastructure. It will have to set an average price for each infrastructure type.

2.6.1.2 Application certification fee

Customer Segment	Sub Segment		# app's/year	One Shot Average Price	One Shot Rev	Annually % Rev	Annually Rev
Users: Developers & Citizens	**Developers**		**23**		**1.700 €**		**75 €**
		SMEs, corporate and freelancers	10	150 €	1.500 €	5%	75 €
		Hobbyists, students and enthusiasts	8	25 €	200 €	0%	0 €
	"Social" Citizen Communities		5	0 €	0 €	0%	0 €
City management, SME & Companies	**SME**		**6**		**4.500 €**		**225 €**
		Class 1	2	500 €	1.000 €	5%	50 €
		Class 2	2	750 €	1.500 €	5%	75 €
		Class 3	2	1.000 €	2.000 €	5%	100 €
	Corporate		**6**		**9.000 €**		**900 €**
		Class 1	2	1.000 €	2.000 €	10%	200 €
		Class 2	2	1.500 €	3.000 €	10%	300 €
		Class 3	2	2.000 €	4.000 €	10%	400 €

Table 7 Application Infrastructure revenue stream

The application certification fees have been calculated based on the number of applications to certificate per year. The average price per certification increases depending on the type of the customer. Zero level would be "social citizen communities" (free service), the top level would be the Corporate (highest price).

In one year we have assumed 35 applications to certificate.

2.6.1.3 Application store purchase

Customer Segment	Sub Segment	Service Level and AVS	# apps/year	Annually Average Price	Annually Rev
Users: Developers & Citizens	**Developers. "Social" Citizen Communities**		**23**		**14.100 €**
		< x transactions month and standard frequency	10		
		Service Level 2 (TBD)	7	800 €	5.600 €
		Service Level 3 (TBD)	4	1.250 €	5.000 €
		Service Level 4 (TBD)	2	1.750 €	3.500 €
City management, SME & Corporate	**SME**		**6**		**15.600 €**
		< x transactions month and standard frequency	1		
		Service Level 2 (TBD)	1	1.600 €	1.600 €
		Service Level 3 (TBD)	2	3.000 €	6.000 €
		Service Level 4 (TBD)	2	4.000 €	8.000 €
	Corporate		**6**		**31.200 €**
		< x transactions month and standard frequency	1		
		Service Level 2 (TBD)	1	3.200 €	3.200 €
		Service Level 3 (TBD)	2	6.000 €	12.000 €
		Service Level 4 (TBD)	2	8.000 €	16.000 €

Table 8 Application store purchase revenue stream

Depending on the segment some constraints will be applied or added services will be offered, in this case the price of the service is different, from low values for users (developers and social citizen communities) to high values to Corporations.

The price depends on the service level and the number of applications. In one year we have assumed 35 applications (with different service levels).

2.6.1.4 Engagement activities

Customer					One Shot	
Segment	**Sub Segment**	**# Infrastructures**	**# Engagement activities per infrastructure**	**% Egagement as a iCity Service**	**Average Price**	**Rev**
Infrastructure Owners	**Cities**	17	4	60%	3.000	120.000 €
	Companies	16	1	20%	5.000	15.000 €
	Social Interest	4	2	100%	0	0 €

Table 9 Engagement activities revenue stream

Incomes are generated according to the number of activities per infrastructure. Realistically, not all activities will be made through iCity, so must be considered a % of these activities will be managed by iCity. The price is different depending on the type of customer.

In this first hypothesis we have assumed 37 infrastructures and a total of 7 activities.

2.6.1.5 Developers' events

Customer					One Shot	
Segment	**Sub Segment**	**# Infrastructures**	**# Engagement activities per infrastructure**	**% Egagement as a iCity Service**	**Average Price**	**Rev**
Infrastructure Owners	**Cities**	17	4	40%	3.000	81.000 €
	Companies	16	1	10%	5.000	5.000 €
	Social Interest	4	2	100%	0	0 €

Table 10 Developers´ events revenue stream

Incomes are generated according to the number of activities per infrastructure. Realistically, not all activities will be made through iCity, so must be considered a % of these activities will be managed by iCity. The price is different depending on the type of customer.

In this first hypothesis we have assumed 37 infrastructures and a total of 7 activities.

2.6.1.6 Learning Courses

Customer					One Shot	
Segment	Sub Segment	# Customers	# Engagement activities per customer	% Egagement as a Service	Average Price	Rev
Infrastructure Owners	Cities	17	4	40%	3.000	81.000 €
	Companies	16	1	10%	5.000	5.000 €
	Social Interest	4	2	100%	0	0 €
City management, SME & Companies	SME	5	2	50%	3.000	15.000 €
	Corporate	5	2	50%	3.000	15.000 €
	City management	5	2	50%	3.000	15.000 €

Table 11 Learning Courses revenue streams

Incomes are generated according to the number of activities per customer. Realistically, not all services will be made through iCity, so must be considered a % of these activities will be managed by iCity. The price is different depending on the type of customer. For social interest is free, for city management, SME and companies is 3.000 € and for infrastructure owners is from 3.000 € to 5.000 € (cities and companies respectively).

There are some documents and videos in the developers' portal that will always be free, therefore there will be no revenue for this way.

In this first hypothesis we have assumed 52 customers and a total of 13 activities.

2.6.1.7 Annual fee

Customer Segment	Sub Segment	# Customers	Annual Fee	Rev
Infrastructure Owners	Cities	4	5.000 €	20.000 €
	Companies	4	7.500 €	30.000 €
	Social Interest	2	0 €	0 €
City management, SME & Corporate	SME	5	3.000 €	15.000 €
	Corporate	5	10.000 €	50.000 €
Users: Developers & Citizens	Developers	15	1.000 €	15.000 €

Table 12 Annual fee revenue stream

Depending on the segment some constraints will be applied or added services will be offered, in this case the price of the service is different, from low values for users (developers and social citizen communities) to high values to Corporations.

In this first hypothesis we have assumed 62 customers with an average price which varies between 0€ for social interest groups to 10.000 € for Corporate.

2.6.1.8 Sponsor

We have identified several opportunities by private companies to sponsor some activities related to operations, e.g.: hosting, sponsored events, developers activities, but it could be necessary to be evaluated case by case.

Sponsors can help generate revenues or can help reduce cost offering services that would have to outsource.

(This section will be developed and further analysed in following updates.)

3 Summary and comments

Throughout this document we have shown a consistent business model for the iCity initiative.

First, we have analysed how the smart city context creates a new scenario that must be covered using a different approach from classic city infrastructure management. The resulting analysis includes a value chain with four distinct parts:

- **Public and private infrastructures**, including many kinds of data acquisition devices and actuators in real time.
- **The iCity platform**, that provides a unified integration point for infrastructures and a common API for services distribution and applications
- **Public services providers**, city management and utilities
- **Community and third party applications** for the citizen

Using the new value chain as reference, we have developed a business model using the canvas methodology. . First, we have identified these customer's segments:

- **Infrastructure owners**, which are SMEs, enterprises and public entities responsible for the city's infrastructures. Thanks to the iCity approach, owners of infrastructures do not have to provide independent, custom vertical services on top of their IT. Instead, they rely on iCity to integrate their data into a homogeneous platform with common services, management tools and security.
- **City management**, which are also SMEs, enterprises and public entities responsible for implementing and/or operate city services, and make use of the iCity platform as a single point of integration to city infrastructures.
- **Developers and citizens**. While developers generate applications and services that use the iCity platform as their backend, citizens are the final customers of these applications and benefit from the service catalogue.

Once the customers have been identified, we analyse relationships with them. Depending on the customer, relationships may be as generic as a self-service relationship using web portals, forums and blogs or as specific as personal assistance and co-creation with distinguished partners.

To properly communicate with these customers, different channels are also identified, from automated generic solutions, like feedback on the app stores, to the more dedicated agreements with city officials.

To complete the revenue side of the model, we have established the revenue streams from each customer. These may be, among others, fees to developers or integrators, incomes from sponsoring or revenues from application store purchases.

On the cost side of the model, we have listed key activities the business executes to deliver the value proposition. Since iCity is a software platform, many of the activities are related to software engineering, but there is also a significant effort coming from other activities like governance and community management.

The second task of the cost side is to identify key resources. The cloud or production platform is the heart of the system, powered by an heterogeneous force of professionals on different knowledge areas, from software development to legal management, Branding is also a powerful resource.

A strong network of alliances and key partnerships plays a very important role on the success of the project as it optimizes the business model, distributes the effort, reduces the risk and increases the number of infrastructures and services.

Finally, key activities, resources and partnerships are the building blocks of a realistic cost structure in which cloud services, platform development, support and human resources, among others, are taken into account to make the business profitable to all stakeholders.

The full canvas provides with a unique view of the solution from a business perspective, in which subsequent interactions will deepen in each of the predicates and assumptions included in the analysis to increase the level of detail and consolidate the model.

Some of the topics that will need a more detailed analysis are related to:

1. **Citizen engagement**: how citizens become more involved and integrated with the work of iCity municipalities. The result could be new models of citizen engagement and co-production of new types of service delivery.

2. **Quality of life**: These are models that drive significant improvements in the quality of life, focus on healthcare, living, education, safety, environment, ...

3. **Transformation**: iCity has to be able to converge the applications from bottom-up level to top-down level, between user and city and between city and user in the same value.

4. **Local communities**: models that help iCity members to create a sustainable local ecosystem that encourages people (residents, workers and visitors) to generate wealth and create new economic activities.

5. **Co-evolution** of services between different cities and between all members, generating synergies and experiences, sharing knowledge.

6. Many synergies are observed on the cost side but on the revenue side the several income mechanisms strongly depend on the customer segment they are referring to. In iCity the different agents involved share the same costs structure.

7. Building plausible **Business model scenarios**. In this regard, three different approaches have been considered: cloud platform (shared services); in premises platform; and mixed. More interactions between the members of the consortium and the ecosystems should be reinforced and studied.

(This section will be developed and further analysed in following updates.)