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Can Context Influence a Smart City Project? Case Study of two projects in Brazil

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O Contexto pode Influenciar um Projeto de Cidade Inteligente? Estudo de Caso de dois projetos no Brasil

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Abstract

This is a study on smart city projects in Brazil and the influence of local context on the projects conception. A qualitative research was conducted on two different smart city projects from distinct regions of Brazil: the city of Campinas, from the southeastern region, and the city of Salvador, from the northeastern region. Both projects fall under the same national guidelines for technology development, the ENCTI 2012-2015. The projects policies were compared to understand if and how local context can shape a smart city project.

Keywords: Smart City; Information Technology; Urban Development; Context; Brazil.

Resumen

Este es un estudio sobre proyectos de ciudades inteligentes en Brasil, y la influencia del contexto local en la concepción de esos proyectos. Se ha hecho una investigación cualitativa sobre dos proyectos diferentes de ciudades inteligentes de diferentes regiones de Brasil: la ciudad de Campinas, en la región sudeste, y la ciudad de Salvador, en la región noreste. Ambos proyectos están enmarcados en las mismas directrices nacionales para el desarrollo de ciencia, tecnología e innovación, el ENCTI 2012-2015. Las políticas de estos proyectos fueron comparadas y analizadas para entender si, y como, el contexto local puede influenciar un proyecto de ciudad inteligente.

Palabras clave: Ciudad Inteligente; Tecnología de la Información; Desarrollo Urbano; Contexto; Brasil.

Resumo

Este é um estudo sobre projetos de cidades inteligentes no Brasil e a influência do contexto local na concepção desses projetos. Uma pesquisa qualitativa foi realizada em dois projetos diferentes de cidades inteligentes de diferentes regiões do Brasil: a cidade de Campinas, da região sudeste, e a cidade de Salvador, da região nordeste. Ambos os projetos se enquadram nas mesmas diretrizes nacionais para o desenvolvimento de ciência, tecnologia e inovação, o ENCTI 2012-2015. As políticas dos projetos foram comparadas e analisadas para entender se e como o contexto local pode influenciar um projeto de cidade inteligente.

Palavras-chave: Cidade Inteligente; Tecnologia da Informação; Desenvolvimento Urbano; Contexto; Brasil.

1   Introduction

Smart city projects in developing countries must face two challenges: the worlds fast urbanization and structural, historical challenges ((Cunha et al., 2016)). Brazilian cities represent such cases. Brazil's vast territory possesses differences rooted in historical inequalities and urbanization. This research studied two smart city projects in Brazil, to understand how policymakers are adapting their plans to their own context, and how historical socioeconomics inequalities and city agendas are being addressed by smart city policies.

During the year of 2011, the Brazilian federal government passed a development plan, the Plano Brasil Maior (Greater Brazil Plan). This plan proposed a series of guidelines for technology development in Brazil, under the Estratégia Nacional de Ciência, Tecnologia e Inovação – ENCTI (National Strategy for Science, Technology and Innovation), linked to the then Ministry of Science and Technology of Brazil. This research studies two smart city plans of the same period as the ENCTI guidelines, both located on different regions of Brazil: the city of Campinas, from the state of São Paulo and Salvador, capital city of the state of Bahia.

The case studies are compared in tables, with their policies displayed side by side, to understand their similarities, how each one is following the ENCTI guidelines, and their differences. Also, the policies are divided into four different domains of actions, an adaptation of Neirotti et al. (2014) classification of domains and sub-domains of actions of a smart city. Finally, this research dialogues with Cunha et al. (2016) understanding of smart cities in Brazil by studying how those two municipalities are adopting and shaping a smart city model to their own realities.

The remaining of this article is organized as follows: the theoretical background; the method of comparison, justification and initial presentation of the case studies; the results with the comparative tables divided into four domains along with the analysis of each table; a discussion of the results; and the conclusion.

2   Theoretical background

As stated by Walsham (2017), the field of Information and Communication Technologies for Development (ICT4D) is multidisciplinary. Walsham (2017) describes the mid 2000's to present date as a period of "proliferation", due to the "explosion of technology in developing countries" and to the "many disciplines involved in ICT4D research". Following this line, texts and authors from different fields of knowledge were chosen for an initial understanding of smart city concepts such as: what defines a smart city? What are the possibilities and impacts of information and communication technologies (ICTs) for urban development?

2.1   Smart City

The authors reviewed classifies Smart cities into two groups: cities of sensors where ICTs are used for a more efficient response on domains such as urban infrastructure and energy efficiency and cities that uses ICTs for more democratic and bottom up approaches to public decision-making. As noted by Antoine Picon (2015), those two paradigms can coexist. Neirotti et al. (2014) defines those two paradigms as "hard" and

"soft". "Hard" is the approach with focus on "production and the distribution of energy, transportation and logistics, waste management and pollution control, and it looks at the way ICT can harness information processing in these fields." ((Neirotti et al., 2014)). The "Soft" approach uses ICTs to promote bottom up initiatives with users. Authors such as Richard Sennett and Antoine Picon have similar definitions of smart cities to the one presented by Neirotti et al (2014).

Sennett and Picon both categorize the use of information technology into two groups: Open and Closed Systems (Sennett, 2018) or Collaborative City and Neocybernetic (Picon, 2015).

The Open system / Collaborative City has a decentralized nature. It relies on user's feedbacks and interactions to facilitate access to services, generate data that could be analyzed for a better understanding of a situation or even stimulates direct democracy by bridging the gap between the city hall and citizens. Commonly through the use of collaborative platforms, such as smart phone applications, online platforms or social medias, actions in this category could provide more accessibility to citizens, for example, by creating a platform that allow for public vote on budget spending by the city hall. The open system also allows underrepresented actors to have participation, to engage in politics, to be seen and make history, even if they do not manage to change the system (*Sassen, 2017*).

The Closed System / Neocybernetic City has a centralized core that process data and act accordingly. It usually relies on sensors to generate data in order to better understand a system or to help its functioning. As an example, the widespread use of sensors to predict traffic jams or to control and analyze the quality of air and water, which could help combat pollution. The Closed System usually falls under a "top down" approach, which thinks a city through a macro concept, that is then implemented to the micro scales (Ratti, 2016). Songdo, in South Korea, is an example of a closed system city, due to its macro plan of efficiency and functionality based on data collected by sensors and processed by computers. Songdo possess a centralized control core that supervises and processes the data collected (Sennett, 2018).

2.2 Steps for a Smart City

Cunha et al. (2016) identify four evolution stages of a smart city, briefly summarized below:

Vertical: Integration of technology and urban services, such as public lighting, transportation, sewers. The technology can be used to optimize the services and infrastructure, and to monitor them in real time.

Horizontal: Integration of the different services, with the development of an online management platform.

Connected: Interconnection of the different agents within the city and the digital platform and services. This stage sees the connection of citizens and urban services, businesses, universities, which could help, for instance, decision makers and citizens with real time information.

Smart: This final stage sees the implementation of scalable, high-end technology in the entire city, which would allow for predictions to be made based on statistical data. This is the stage of shared intelligence that could benefit all agents in the city.

Cunha et al. (2016) analysis show that Brazilian cities are mostly on the Vertical stage, with a few rare exceptions of cities that are developing programs for the Horizontal stage.

3 Method

Two smart city projects in Brazil were selected for a comparative analysis. By selecting smart city projects from a similar time frame but located in different regions, the national guidelines for each becomes a static parameter for the comparison, and the differences between the policies would come from their context. The scope of this article is limited to analyzing the policies proposed.

Brazil is divided into five macro regions: North, Northeast, Central-West, Southeast and South. The regions selected are the Southeast region and the Northeast region of Brazil, due to their historical and socio-economical differences. The Southeast region Municipal Human Development Index (HDI) is 0,766 (2010), the highest in Brazil, while the Northeast region is 0,663, the lowest in the country in 2010. ((United Nations Development Programme et al., 2016)). Also, the Southeast region boasted the highest gross domestic product (GDP) of Brazil in 2012, R$ 2,424,005 (millions), and the second highest nominal GDP (R$ 29,728.34) (*IBGE, 2012*). In comparison, the Northeast region of Brazil possessed the third highest GDP among the macro regions, R$ 595,382 (millions), but the lowest nominal GDP of the country (R$ 11,044.59) (*IBGE, 2012*).
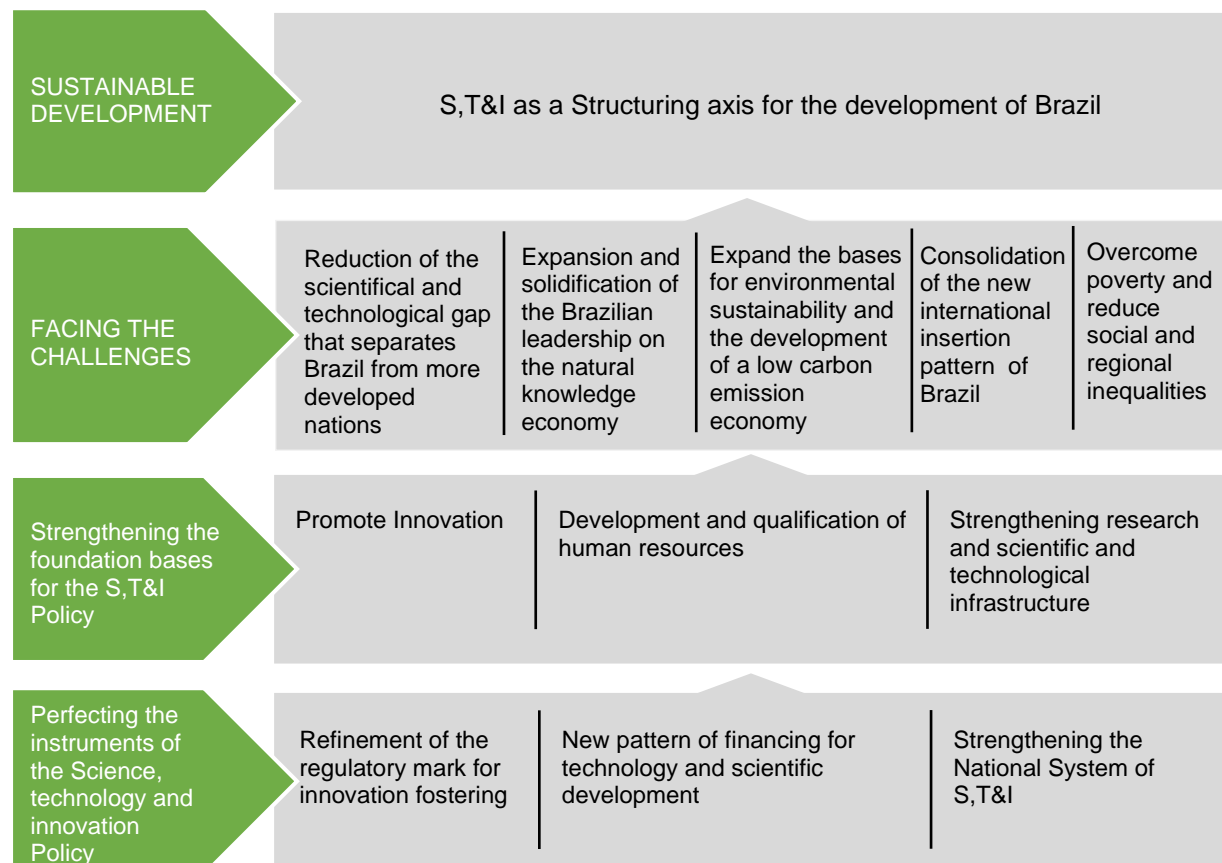
During the ENCTI 2012-2015 period, ICT projects were developed in different cities of Brazil, such as the Plano Estratégico de Ciência, Tecnologia e Inovação de Campinas – PECTI (Strategy Plan for Science, Technology and Innovation of Campinas) planned for 2015 to 2025, and the Salvador 360, which was envisioned by the 2013-2016 local government of Salvador. Also, in 2019, the city of Campinas was awarded first place on the Ranking Connected Smart Cities, developed by Urban Systems and Sator (Connected Smart Cities, 2019), as the city with the highest potential for growth in Brazil, based on intelligence, connection and sustainability indicators. Although Salvador ranked 39º on the same rank, it placed 2º among the cities of the Northeast region. In addition, due to easy to find material on those projects, from government official internet sources, news reports and easy access to government officials, both cities were chosen for the qualitative analyses.

This research uses a model of classification tables derived from the ones created by Neirotti et al. (2014), which classify smart city policies into six different domains: "Natural resources and energy"; "Transport and mobility"; "Buildings"; "Living"; "Government"; and "Economy and People". Those domains are adapted to better fit this research and the chosen projects, and for that, four classification domains were proposed: 1 Sustainability, Renewable Energies and Energy Efficiency; 2 Entrepreneurship, Innovations and Creative Economy; 3 Interface with Urban Infrastructure; 4 Interface with Citizens.

After comparing the chosen smart city plans policies, the analysis was based on their similarities to the ENCTI and how they are responding to local necessities, challenges and demands. The analysis is also influenced by Cunha et al. (2016) understanding of a smart city project implementation.

3.1   ENCTI (2012-2015)

The ENCTI 2012-2015 strategy is a continuation of the Plano de Ação em Ciência, Tecnologia e Inovação (Science, Technology and Innovation Action Plan, or S,T&I) – PACTI of 2007-2010. The strategy starts with a research on the tendencies of ICTs and other technologies worldwide, and their potentials and challenges of use and implementation in Brazil. The strategy map for the ENCTI (2012-2015) and the main guidelines pertinent for this research are transcribed below (*MCTI, 2011*):

SUSTAINABLE DEVELOPMENT	S,T&I as a Structuring axis for the development of Brazil				
FACING THE CHALLENGES	Reduction of the scientifical and technological gap that separates Brazil from more developed nations	Expansion and solidification of the Brazilian leadership on the natural knowledge economy	Expand the bases for environmental sustainability and the development of a low carbon emission economy	Consolidation of the new international insertion pattern of Brazil	Overcome poverty and reduce social and regional inequalities
Strengthening the foundation bases for the S,T&I Policy	Promote Innovation	Development and qualification of human resources		Strengthening research and scientific and technological infrastructure	
Perfecting the instruments of the Science, technology and innovation Policy	Refinement of the regulatory mark for innovation fostering	New pattern of financing for technology and scientific development		Strengthening the National System of S,T&I	

ENCTI 2012-2015 Strategy map (MCTI, 2011). Translated and adapted by the authors.

Promoting Innovation on Enterprises: Expand enterprise participation in Brazils technological efforts, to increase competitivity on national and international markets.

New pattern of public financing for scientific and technological development: Expand resources destined to the development of the national scientific base and to technological innovation.

Strengthening research and scientific and technologic infrastructure: To strength research and the scientific and technological infrastructure, to provide creative solutions for the Brazilian society demands and a Strong base for innovation efforts.

Development and Qualification of Human Resources: Expand trained human capital to meet the demands for research, development and innovation in strategic areas for Brazils sustainable development.

Priority Programs for Future-bearing Sectors:

ICTs – Information and Communication Technologies: Strength the national ICT sector and its production chain, to increase local content, competitiveness and participation in national and international markets.

Innovation Frontiers:

Biotechnology: To develop innovative biotechnologies that add value, promote the sustainable use of biodiversity and integrate new technologies.

Nanotechnology: To promote the generation of knowledge and the development of nanotechnological products, processes and services aimed at increasing the competitiveness of brazilian industry.

Green Economy Promotion: To consolidate the scientific and technological basis necessary for the transition to a green economy and foster innovation in clean and renewable energy, biotechnology, biodiversity and climate change.

Renewable Energies: Develop technologies for the production chains of biofuels and other renewable energies, as to diversify and preserve their participation in the Brazilian energy matrix, ensuring energy security and efficiency.

Biodiversity: To expand scientific knowledge about Brazilian ecosystems and associated biodiversity and support technological development and innovation to add value to the goods and services derived from this natural resource.

Climate Changes: To expand the capacity to respond to the challenges and opportunities associated with climate change.

Oceans and Coastal Areas: To place Brazilian oceanographic research on the international level and understand the role of the South Atlantic in climate change projected towards the end of this century.

S,T&I for Social Development: To develop and disseminate knowledge and creative solutions for productive and social inclusion, the improvement of quality of life and the exercise of citizenship.

Popularization of S,T&I and improvement of Science Teaching: To promote the improvement of scientific education, the popularization of S&T and the social appropriation of knowledge.

Production and Social Inclusion: To develop and apply social technologies and promote technological extension for production and social inclusion.

Technologies for Sustainable Cities: To develop and disseminate technologies that contribute to the economically viable, socially fair and environmentally sustainable cities.

The guidelines presented are composed of different strategies. While comparing the cases, those individual strategies were used as parameters to understand the route each individual plan followed. E.g., while analyzing strategies related to the Promote Green Economy guideline, one plan issued more policies aligned with the smart grid and diversification of energy sources, and the other issued policies toward diversification of energy sources and biodiversity. This method allowed for some conclusions on the similarities and differences in the strategies, but also, on how and which contextual factors shaped the policies.

3.2 Case Studies

Salvador – Salvador 360

The city of Salvador is the capital of the state of Bahia on northeast Brazil. It was founded on 1549 and was the first capital of Brazil. Salvador has an estimated population of 2,872,347 (2019), an area of 693.931 km² (2018), a GDP per capita of R$ 21,231.48 (2017) and is an important touristic destination in Brazil (*IBGE | Cidades@ | Bahia | Salvador | Panorama*). Its Historic Centre was designated a World Heritage site by UNESCO in 1985 (UNESCO World Heritage Centre, n.d.). Salvador tourism is also boosted by its natural resources such as national preservation parks of native Atlantic Forest, beaches, and marine park. The incidence of poverty in Salvador's population is of 35,76% (*IBGE | Cidades@ | Bahia | Salvador | Pesquisa | Mapa de pobreza e desigualdade | Incidência da pobreza*), and 42% of its workforce works in the informal economy (IBGE 2015 and RAIS 2015, apud *Salvador 360*).

Salvador currently undergoes a plan to modernize its infrastructure and make the city more appealing for investors and entrepreneurship. Under the name Salvador 360, the plan was envisioned under the 2013-2016 City Hall administration. The plan is built on Salvador strengths, incorporating the existing natural resources for actions that follow the ENCTI guidelines of environmental sustainability and low carbon emission economy. It also proposes to expand the tourism economy, and to fight the high poverty rate by creating jobs in different sectors of the economy, supporting micro entrepreneurs and regulating land ownership in poor neighborhoods. the Salvador 360 is divided into eight axis, summarized below:

Simplifica (Simplify): reduction on the bureaucracy in order to facilitate government efficiency and the services it provides, and to make a more dynamic business environment.

Negócios (Business): enhance entrepreneurship, create jobs and incomes and shorten the distance between jobs and housing.

Centro Histórico (Historic Center): Actions within the Salvador Historic Center, aiming to enhance the tourism industry and dynamize the local economy.

Inclusão Econômica (Economic Inclusion): regulation of informal sector economic activities.

Cidade Sustentável (Sustainable City): Government incentives for sustainable businesses and equipments, creation of parks and contributions with the Paris Agreement.

Cidade Criativa (Creative City): Government incentives to creative economy initiatives and enhancement to the city's international capabilities.

Cidade Inteligente (Smart City): Use of technology to enhance the city's administration and services efficiency, and to incentive new economic axis.

Investe (Invest): Public investments into infrastructure and Public-Private Partnerships (PPPs).

Campinas – PECTI

The city of Campinas is in the state of São Paulo and was founded on 1774. Campinas has an estimated population of 1,204,073 (2019), an area of 794.571 km² (2018) and a GDP per capita of R$ 49,942.59 (2017) (*IBGE | Cidades@ | São Paulo | Campinas | Panorama*). Campinas is an important university hub in Brazil, housing Unicamp – 5th best university of Latin America, and 2nd in Brazil, according to QS Latin American University Rankings 2020. The incidence of poverty in Campinas population is of 9,83% (*IBGE | Cidades@ | São Paulo | Campinas | Pesquisa | Mapa de pobreza e desigualdade | Incidência da pobreza*).

The focus of this study was the Plano Estratégico de Ciência, Tecnologia e Inovação de Campinas (Campinas Science, Technology and Innovation Strategic Plan), or PECTI, a development plan for the city that includes incentives to entrepreneurship and startups, investments on infrastructure and widespread accessibility of internet and cultural equipment, investments by Public–Private Partnerships (PPPs), use of information technology to enhance the public services provided by the City Hall. The PECTI plan was envisioned in late 2013, in a coordinated effort between Campinas city hall representatives with local S, T&I institutions. The strategy was developed and is being implemented by the Secretaria Municipal de Desenvolvimento Econômico, Social e Turismo (Municipal Department for Economic, Social development and Tourism). An interview with a representative of this Department was conducted for a better understanding of the urban planner view. One of the goals of PECTI is the promotion of the "Campinas Brand": for Campinas to be recognized as a "city of knowledge and innovation". PECTI describes Campinas

as a city known for its important technological and scientific hubs, and for undergoing an increase in urban density (PECTI, 2015, p. 20). The guidelines adopted by PECTI reflect this existing technology center, comprised of the universities and enterprises, as well as the city own goal of strengthening this center and attracting more investments and enterprises.

The PECTI follows the ENCTI guidelines for ICT implementation and development. It proposes three guidelines for development, summarized below ((*PECTI-de-Campinas-2015-2025-Livro-Em-Pdf.Pdf*, n.d.)):

Market and Society: This guideline is comprised of the strategies: Promote the Campinas City Brand; Promote Social Innovations; Diversify Energy Sources; Attract Investments and Retention of Knowledge Intensive Enterprises; Capture Market Opportunities.

Government: This guideline is comprised of the strategies: Development and Implementation of Taxation Policies for Knowledge Intensive Enterprises; Public Administration Efficiency and New Tools; Improvement of Public Services; Implementation of the Urbanistic Administration; Implementation of the Digital Campinas.

Triple-Helix: This last guideline is comprised of the strategies: Creation and Strengthening of the Municipal Agency for Development and Innovation; Strengthening of Technology Parks; Qualification and Capacitation of Human Resources; Strengthening the interactions between Government, Enterprises and Universities, aiming to improve Applied Knowledge and Development; Business Accelerators and Incubators.

4   Results

The analysis of each domain is presented below, after its own respective comparative table.   The comparative tables are divided into four domains: Sustainability, Renewable Energies and Energy Efficiency; Entrepreneurship, Innovation Projects and Creative Economy; Interface with Urban Infrastructure; and Interface with Citizens.

4.1   Sustainability, Renewable Energies and Energy Efficiency

PECTI - Municipal Office of Economic, Social development and Tourism of Campinas	Salvador 360 - Salvador City Hall
Increase in the participation of renewable energies in the city's energy sources	Investment in sustainability measures
Green Economy tax incentives (IPTU Verde)	Green Economy tax incentives (IPTU Verde, Outorga Verde)
Research on alternative energy sources (solar, biomass from wastes and small hydroelectric powerplants)	Selective waste collection program and creation of a composting plant
Goal: universalization in the use of renewable energy sources	Native forest conservation, reforestation and maintenance of preservation areas
Smart Grid	Revitalization of the Botanical Garden
Car-sharing	Program: Salvador Atlantic Forest Capital (Salvador Capital da Mata Atlântica)
Stimulus to alternative transports	Stimulus to alternative transports
-	Municipal Housing Tax cuts as incentives to local implementation of solar panels (IPTU Amarelo)
-	Goal: generation of 1 megawatt by solar energy from public buildings

-	Blue Flag Certificate for Beaches
-	LED investment

Table 1: Sustainability, Renewable Energies and Energy Efficiency

Both PECTI and Salvador 360 have similar policies that follows ENCTI guidelines, such as diversifying energy sources and incentives to alternatives for the individual vehicle. For diversifying energy sources, a common ground found is individual incentives by municipal housing tax cuts (IPTU). Both plans mention solar energy as an important alternative, and clean, energy source, but also present other alternatives such as biomass through waste. For impacting vehicle traffic, both plans propose stimulus for bicycles and improvement to local public transportation, such as real-time monitoring and disclosure of buses location and arrival time.

The differences in the policies for Sustainability, Renewable Energies and Energy Efficiency show the different goals and priorities of each city. For Campinas, the PECTI strategy gives incentives to scientific and technological research for alternative energy sources and creation of a smart grid for efficient energy management. Those policies are in line with the city of Campinas own goals of creating the Campinas Brand, as a "City of Knowledge", with a high integrated environment between enterprises, university and government. The development and implementation of a smart grid and the research on alternative energy sources for Campinas would come from enterprises, such as Companhia Paulista de Força e Luz (CPFL), using federal resources from the National Agency of Electric Energy that are destined to research and development. This policy comes naturally for Campinas, a city that houses technology enterprises -such as CPFL – and intends to attract more.

The city of Salvador possesses a diverse biome, present in its Atlantic Forest parks, marine park and beaches. This is reflected on the strategies chosen for Salvador 360 plan for Sustainability. Instead of researching energy efficiency technologies, such as the PECTI proposes, Salvador 360 follows the ENCTI guidelines directed to investments in biodiversity research and the promotion of green economy. Some of the most notable policies are: reforestation of natural areas, and plantings of trees in urban corridors and public squares; investments on natural parks, researches and areas of exposition/public contact; involvement of citizens with the reforestation, with programs such as "Disque Mata Atlântica" (Call Atlantic Forest), which gives citizens direct contact to teams working on the city atlantic forest parks, and allows for the delivery or take out of native seedlings for planting, all through phone or whatsapp messages. Salvador 360 also proposes sustainable policies for its beaches and coastal areas, such as qualification through the blue flag eco-label, and investment on its natural marine park.

4.2   Entrepreneurship, Innovation Projects and Creative Economy

PECTI - Municipal Office of Economic, Social development and Tourism of Campinas	Salvador 360 - Salvador City Hall
Creation of the Municipal Development and Innovation Agency to deal directly with companies and entrepreneurs	Debureaucratization for companies and entrepreneurs
Investments in training and technical capacitation for the workforce	Tax incentives for companies and enterprises
Investment in the universalization of foreign languages	Training and qualification of the workforce.
Debureaucratization and decentralization of public services	Incentives to 7 different economic sectors (creative economy, technology, textile, call centers, retail, tourism and construction).
Investments in business incubators and accelerators	Support for micro-entrepreneurs and informal workers.

Attracting venture capital	Empowerment of woman through capacitation, entrepreneurship support and access to microcredit.
Creation of co-working spaces	Investments in cultural areas and digital media to enhance the creative economy and tourism
-	Creation of an online platform to connect workers with job opportunities.

Table 2: Entrepreneurship, Innovation Projects and Creative Economy

An overview of the plans shows similarities between them, such as investments on entrepreneurship, incubators and business accelerators and debureaucratization, which falls in line with ENCTI general guidelines for the promotion of business innovation. Nonetheless, there are differences in the plans that could offer insights on how policies are adapted for each city context. The PECTI strategy proposes an integrated environment between universities, government and the private sector to stimulate innovation and research on development and technology. This capitalizes on Campinas own infrastructure, being a university and research hub, and promotes the "Campinas Brand", already mentioned as a main goal of the PECTI strategy.

On the other hand, Salvador 360 supports incentives towards informal workers, who comprises almost half the workforce of the city. To tackle this historical deficit, the plan identifies the need of action in two main fronts: capacitation and access to microcredit. The administration of Salvador identifies the importance of empowering women, as they comprise most of the microentrepreneurs they are targeting (Salvador 360). For that, the plan promotes capacitation in entrepreneurship through agents (the "entrepreneur agent", Salvador 360) trained in giving support such as teaching how to create a business model, promoting the business, how to gain access to microcredit and direct contact with microcredit agents, all that integrated with local schools. Local municipal schools are seen by the government as a place where woman have already stablished a trusting relationship and formed a community with other mothers, therefore, they were chosen as the place for the agents to work and spread the plans entrepreneurship support. Access to microcredit will happen in partnership with the Banco do Nordeste ("Northeastern Bank"). Capacitation programs are also proposed in partnership with SEBRAE (which is an ENCTI guideline).

Salvador 360 also uses ICTs to create a platform, accessed by cellphones as an application, that integrates job opportunities to registered workforce and services by microentrepreneurs – the SIMM platform (Municipal Labor Intermediation Service). Another structural, historical problem of Salvador are irregular housing. The plan wants to regulate housing by changing zoning laws, recognizing ownership and the rights of use of the residential land. The changing in the zoning laws will also permit immediate opening of business in the new zone. Altogether, those two policies, of supporting microentrepreneurs and regulating houses, are an effort to address local problems of social inequalities in this smart city project.

Salvador 360 also promotes tourism by incorporating ICTs into more traditional cultural activities, such as the gastronomy and fashion fairs promoted online by webseries, or by creating a center for generation of online content ("Youtube House"). Salvador goes beyond the ENCTI guidelines, by reaching different creative economy sectors, such as the E-Sports, with the creation of an arena and sponsoring video-games tournaments that are transmitted online, such as League of Legends. As an extra incentive to the hotel sector, the city will tax irregular applications and will create an official certification. Again, those actions show the influence of the tourism economy that is already strong in the city.

There is a difference in the proposals of PECTI and Salvador 360 that highlight the contrasts of each city. Salvador 360 will offer tax cuts and incentives to seven economic sectors (creative economy, technology, textile, call centers, retail, tourism and construction). Many jobs proposed by Salvador 360 are to address the city problems with poverty and informal workforce. Meanwhile, PECTI wants to bring to Campinas high qualified and specialized jobs, by offering tax incentives to research and development sectors, as well as leveraging the city infrastructure and its technology and university center. It specifically lists as a priority of the plan to attract and retain knowledge intensive enterprises.

4.3   Interface with Urban Infrastructure

PECTI - Municipal Office of Economic, Social development and Tourism of Campinas	Salvador 360 - Salvador City Hall
Smart traffic lights	Smart traffic lights
Public-Private Partnerships for the creation of cultural equipment's	Traffic control and safety centers
Car-sharing services and zoning changes	Digital platform for investment in urban infrastructure with citizens participation
Universalization of internet access	Qrcode in tourist attractions
Use of abandoned buildings to recover degraded areas of the city.	Free wi-fi internet for the entire city
-	Investment in public spaces infrastructure
-	Improvements in urban mobility integrated with an online platform

Table 3: Interface with Urban Infrastructure

The Salvador 360 and PECTI plans have similar policies, such as the creation of intelligent traffic lights to mitigate the effects of vehicle traffic and the universalization of internet access.

PECTI propose investments through Public-Private Partnership model in public educational and cultural spaces, such as technology museums, libraries, and media centers. PECTI also foresees changes in the zoning law, together with car-sharing measures and smart traffic lights, to mitigate the effects of vehicle traffic. Also, PECTI intends to requalify abandoned buildings to recover degraded areas of the city by offering popular housing, public services, spaces for entrepreneurship, social areas and as places to expand the technology parks.

Salvador 360 creates monitoring and surveillance control rooms to monitor the city through installed cameras as an additional measure for improving traffic control and public safety. As part of the plan's Historic Centre Axis, it proposes to link QR codes to historical monuments as to give a digital, interactive, dimension to them. This Axis also expects improvements to the historic center of Salvador infrastructure, such as underground electric cables, projects for better sidewalks, restoration and/or requalification of historic monuments and buildings, as well as improvements to pedestrian accessibility infrastructure overall.

The plan for Salvador offers a direct interface between the municipal government and citizens, through the Platform Listening to Our Neighborhood (Ouvindo Nosso Bairro). This platform allows residents to choose how public funds directed to their neighborhood are spent through an online voting system, where the most voted proposals receive priority. Another measure adopted by the plan is the interaction of users with public transportation through a municipal government platform, created in partnership with Cittamobi (an enterprise that offers real time public transportation tracking as a service). This platform offers precise tracking of buses through GPS to facilitate routes, while also providing a direct contact channel with the users, who can interact reporting failures and pointing improvements to the buses and to general infrastructure of the city.

ENCTI influence can be seen in both plans in this category, in policies such as universal internet access, use of ICTs in strategic areas such as public security, transportation, energy and education. One of the ENCTI axis for development is the popularization of ICTs and the widespread education of technology, science, and culture, with an emphasis on interactive museums. Both plans have policies for the creation of such educational spaces, although by different methods.

The PECTI strategy creates a Public-Private Partnership model for the construction of museums and technology spaces. Salvador 360 proposes creation of spaces for technology popularization and education,

such as the already mentioned YouTube House and the E-Sport Arena, but it also has a restoration and qualification plan for its historical center. Salvador 360 policies for creation of educational spaces have more emphasis on restoring and requalifying existing historical buildings, than creating new ones, which goes with the city strategy of reinforcing its tourism industry.

4.4 Technology Interface with Citizens

PECTI and Citizens Portal (Portal do Cidadão)	Salvador 360 - Salvador City Hall
Platform for direct contact with public agencies.	Free wi-fi internet for the entire city.
Direct interaction between citizen and public agencies, through an integrated platform with citizen registration.	Contact platform for public agency services - Simplify Platform (Portal Simplifica).
Single Registration for citizens.	Platform Listening to Our Neighborhood – Ouvindo Nosso Bairro.
Citizen's Portal – Portal do Cidadão	Cittamobi platform for citizen interaction about transportation.
Social security number.	-
Universalization of Internet in Campinas.	-
Transmission of public hearings online, with the possibility of voting through access (and registration) on the online platform.	-

Table 4: Technology Interface with Citizens

Both the Salvador 360 plan and the actions in Campinas intend to offer a direct dialogue interface between citizens and their representatives. In Salvador, CittaMobi platforms, "Ouvindo Nosso Bairro" (Listening to Our Neighborhood) and "Simplifica" (Simplifies), use information technology to facilitate public transportation routes (with the possibility of pointing out improvements and failures in the system and urban infrastructure), as a decision mechanism on municipal budget expenditures, and to provide public services through an easy and direct way.

In the case of Campinas, the online platform Portal do Cidadão grant access to services and monitoring of various municipal processes. It is possible to schedule attendance in the city hall, consult and generate a copy of the property tax, keep track of school reports of dependents and even follow any process issued by the registered citizen (through Individual Taxpayer Registry) in real time. The PECTI plan aims to create the Single Citizen Register and social security number. This would facilitate the integration of citizens data, including between the network of public and private hospitals, which today are not connected and could help health professionals during an emergency by granting access to the patients' medical records. Another potential of ICTs, pointed out by PECTI, is the online monitoring of public hearings, with the possibility for citizens to vote through registration on the platform.

5 Discussion

The comparison between the plans reveal influences from the ENCTI strategy. There are policies that could be classified into the different models of smart cities studied. "Open System" policies, present in both plans, range from easier access to city services to online platform and other channels of communication between citizens and government. "Closed System" policies are also present in the plans, such as implementation of censors for data-oriented decisions – e.g.: for traffic control and public security – or the proposal for a smart grid, from PECTI.

But, as Cunha et al. (2016) reminds us, in a developing context, there are other structural factors that the planners must address. So, even though the Open System and Closed System policies can be complementary, cities in a developing context usually goes beyond those international models, with different and/or ingenious proposals to tackle their historical needs. That was confirmed in the domains studied.

In Salvador case, there is a mix between policies influenced by ENCTI, and innovations that answer to its own problems of social inequality and its strengths, such as its tourism economy. Salvador 360 proposes policies typically found in open and closed city models, e.g.: smart traffic lights, censors for traffic and public security control or online platform for citizens-government interaction. But it also proposes innovative, original solutions. For instance, in tackling the workforce in the informal economy, it identified the central role of woman in many poor households, being mothers and microentrepreneurs. For that, the plan proposed business training, support and access to microcredit, all through a agents dispersed in municipal schools throughout the city – understanding that the woman have a trusting relationship with the schools and formed, in many cases, a community with other mothers. Other contextual factors that shaped original policies are the "Disque Mata Atlântica", that create a platform for direct contact between citizens and native Atlantic forest parks to request native seedlings for plantation; the "Ouvindo Nosso Bairro" initiative; investments in its Historical Centre and natural resources to strengthening tourism coupled with policies for internet content generation and spread of Salvador culture, such as the Youtube House, E-sport Arena, Fashion and Gastronomy Fairs all broadcasted online.

Compared to Salvador, Campinas is a city with less structural deficits. Due to its already stablished technology and scientific centers, it proposes policies that aim to integrate and develop new technologies, such as the already mentioned smart grid for better energy management. Other examples of contextual influences on the PECTI strategy are the creation of the "Campinas Brand" and the goal to integrate the existing university environment with enterprises and the city hall. Together with investments in infrastructure, business incubators, and workforce capacitation, Campinas expects to create a technological, innovative and entrepreneur environment.

6 Conclusion

There are influences from the ENCTI guidelines found in both plans. Similarities can be found in policies such as the smart traffic light, universal internet access, investments in cultural and scientific infrastructure, debureaucratization. However, the plans show fundamental differences in the areas analyzed, with policies that strengthen their own agendas, such as promoting the "Campinas Brand" or the tourism economy, in Salvador. Furthermore, structural deficits are being tackled in innovative ways, specially in Salvador: to deal with social and housing inequalities, Salvador 360 proposes changes in zoning laws to regulate housing, capacitation of the workforce, creation of an online platform to help workers find job opportunities, and also, recognizing the important role of women as entrepreneurs in the informal economy with actions integrated within the municipal schools – seen as places that already have a trusting relationship with mothers.

The cities agendas and local context, together with the ENCTI guidelines, formed the structure of each plan. For instance, in the Sustainability, Renewable Energies and Energy Efficiency domain, Campinas aim to promote research and development policies in a conjoined effort between the public and private sector. Their goal is to create technological solutions for energy efficiency, such as the smart grid, by using enterprises housed in the city, while also attracting more technology enterprises. Meanwhile, due to its natural resources, Salvador focus on the preservation of its native forests, beaches, and marine ecosystem, with strategies for boosting research and tourism while doing so.

Both plans propose the use of ICTs in innovative ways. Some actions worth noticing are Salvador 360 "Disque Mata Atlântica, "Ouvindo Nosso Bairro" initiative; SIMM Platform; and the Cittamobi platform. While Campinas have the "Portal do Cidadão" platform. Those platforms promote interactions with citizens and are examples of how ICTs can be used to promote citizen participation and direct democracy in a smart city.

Both plans could be classified under the "vertical" stage of a smart city (Cunha et al., 2016), as most ICT actions are focused on creating a technological infrastructure for offering and monitoring services. Although, early indications of the next stage, the "horizontal", can be found in both plans, such as the creation of online platforms that interact citizens, businesses and services. Campinas proposes the "Portal do Cidadão" and a single citizen registry number for ease of access and integration of services into a single platform, as well as direct channel for citizens to interact with the city hall. Salvador 360 have the "Portal Simplifica", that aims to integrate all services provided by the different city hall departments into a single online platform.

Last, the studied smart city projects show that a smart city is more than a pre-existing set of rules. A smart city is, by using Cunha et al. (2016) definition, the use of technology-based solutions to solve emerging problems and also, in the case of Brazilian cities, "well-known, historical (challenges), derived from its formation as a country and its urbanization".

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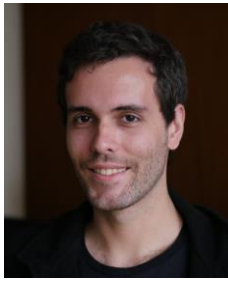
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