ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 3, Issue 2, March 2014

Digital City: Activity Innovation Management in Municipalities of the Metropolitan Region of Curitiba - Brazil

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Abstract - The debate on the question of the contribution of the digital city projects in the innovation management of cities, municipalities and public organizations has been important in the national and international literature, with the help of information technology. The objetive is to analyse the forms and models of digital city projects in the municipalities of the metropolitan region of Curitiba (RMC). The research methodology in case studies, interviews with heads of government, through a research protocol. The analysis made on the basis of the measurement techniques of the types of digital city projects for the characterization of selected municipalities, forms of application, deployment models, met municipal issues, municipal planning instruments used, infrastructure of information technology used to support projects and also their contribution to the direct management of municipalities. Actual results reveal that there is a substantial difference in perception on the subject between the two groups (citizens and municipal managers). The conclusion reiterates the contribution of the method of diagnosis and evaluation of projects of digital city against city innovation management and the provision of information to citizens and the availability of technological tools aimed at providing greater flexibility and efficiency of digital services available to citizens and also way with strategic connotation for municipal managers.

Keywords: **Digital City, Digital City, Innovation Municipal Strategic Management.**

I. INTRODUCTION

With the support of Meta modeling concepts or "modeling of modeling" according to Brooks Jr. [17], its essential components are the plan, its mental conception and subsequent execution of all project related processes. It is closely defined by the project purpose or scope and what is being designed or the result dividing these processes in three different aspects: those defined as the idea, the energy (or implementation) and the interpretation, i.e. the formulation of the conceptual construction, its implementation in the real environment; and the interaction with users in real application.

According to Rezende [11], as projects related to strategy and city information are developed, the city innovation management and the citizens´ quality of life may be improved with the help of digital city projects. These projects also contribute to the planning and provide information, systems and services for residents and managers requiring the participation of municipal managers, municipal officials and citizens.

City managers worry both about the required physical modifications aimed at providing the necessary environment and infrastructure for the full operation of digital cities with its technological resources and urban, cultural and conceptual impacts [29] - [34]. Through these new elements the cities, aiming at greater organization and reproduction of urban spaces, are taking action to reduce the gaps to become networked cities [12], [24], [18] or by getting closer through shrinking distances as expanded cities, including the usage of information and communication technologies (ICT) [35]. These reasons are more than enough for the development of this diagnosis, because through this diagnostic analysis, it was attempted to identify the existence of a standardization or even to help, through concepts, in the planning of these digital city projects and how they have contributed to public administration in the municipalities where these digital city projects were identified and ranked, making this new way of relationship with citizens evident, through the provision of a technological, innovative and broad toolkit, with the practical application of these differentiated technological tools.

The objective is to analyse digital city projects types and models in the metropolitan region of Curitiba (RMC) and their contribution to the management of these municipalities in southern Brazil. In this context are included the municipalities that require timely and structured information that can only be provided if there is planning and

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
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individualized knowledge that can facilitate the decision making process and actions of municipal managers and civil society [11]. This planning in conjunction with structured information will only be able to achieve its goals when they rely on computer systems and information technology resources that support and serve as a platform for these instruments of urban and regional planning, directly assisting the management of municipalities. The cities are exposed to constant changing needs, suffer interference from numerous stakeholders in the municipality (social actors or stakeholders) and face the demands of citizens. These pressures are aggravated by the responsibility of municipal managers to increase the quality of services delivered in the municipalities for the people living in these cities [9].

Current law requires all towns to have a City Multi-Year Plan and certain municipalities to have a City Master Plan. Municipal Strategic Planning requires integration within these plans, not to comply with the law, but to facilitate municipal management, aligning the municipality´s goals, strategies and actions. This integration emphasizes the city planning for a period greater than the four years of the City´s Master and Multi-Year Plans and especially the Mayor´s government program [20], [26], [7], [9], [20]. The topic is relevant and lacks scientific research. The development and implementation of digital city projects can benefit the whole society, improving decision making for necessary actions to improve the practice of public management. And when this planning is designed taking into account the principles of the New Public Management theory, the project can be better executed [36], [30], [31], [8].

II. LITERATURE REVIEW

The theoretical framework describes the underlying theories in which the research is based, providing information found on consulted sources, addressing the concepts and definitions used throughout the investigation, as well as contextualizing the analysis of data collected in the proof of concept.

A. Digital city

We live in a consolidation phase provided by the ICT revolution. Leaving an industrial model, today the formation of the information society - or network society - with the new economic, social and political dynamics, the influence of globalization and the crisis of the state, beyond the undeniable viability and availability of the organization of the territories in cyberspace [24].

The state has also changed before adding new roles and functions and the abandonment of others, it was necessary to reassess the role it plays in society. The government, which once controlled the direction of society today, is to support residents in pursuing their interests. These changes may reflect a globalized society , and that was to serve well the government had to rethink how to act in the existing production processes in government and find ways to improve their internal and external processes, placing citizen satisfaction as one of its main goals [24] - [9].

In modern times, with the advent of globalization and the regional and local competitiveness, householders are seeking new and more modern instruments to be offered by municipal managers, is aligned with government plans of municipalities bring their effective planning. It also is in line with the aim of transforming these new public policies through effective results with the goal of an innovative and differentiated government. Municipalities are faced today with new requirements to both inadequacies in the provision of digital content, such as in providing effective online services. For this reason, it will be important to provide technological, innovative and comprehensive instrumental, through the practical application of the different methodologies [24] - [9].

These new planning instruments associated with the new form of municipal government (or New Public Management theory) form a framework of new and used instruments to combat or alleviate the problems of large and small municipalities. These problems are connected with easy access to essential services (such as scheduling appointments, removal guides for the payment of taxes, check availability of childcare, etc ...). These instruments provide the reorganization, restructuring, reinventing and redesigning the objectives, strategies, decisions and actions at the local level, based on the concepts of entrepreneurship and innovation in the new management employees of the city [3], [24], [9].

Some of the direct benefits provided by digital city projects, city government, will be the modernization of public administration, with the integration, via computer, all entities directly and indirectly, integration, tax financial and

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
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administrative structures, increased tax revenue, better supervision, more immediate access to information and services, communicating via VoIP (Voice over Internet Protocol) [13].

III. THE CONCEPTS OF DIGITAL CITY

Although the "Digital City" subject has more than a decade of studies, the concept, according to Zancheti [38], is still not consensual and varies mainly with the diversity of the development and industrialization degree of the region, its cultural characteristics and sociopolitical situation. It is also associated with the collection and organization of digital information of cities to provide an information space so that residents and visitors interact with each other [32]. It is the digital networked environment created on the territory, that interconnects advanced technological systems in order to connect public services, assets, brands, schools, third sector organizations, businesses, micro and macro communities, providing information on several formats and standards with the purpose of developing the potential of the information society and transforming the citizen into actor and main character of another reality: the virtual [15].

Cities worry about the physical changes to provide the innovation operation of digital cities with their technological resources and related conceptual, cultural and urban impacts [33] - [28]. They require new items for their organization and reproduction of the urban space, shrinking distances as expanded cities, including the usage of ICT [34] or as networked cities [12] - [7].

IV. DIGITAL CITY PROJECTS

There are countless digital city projects in the literature and in the municipalities' practices, including municipal information highways (infovias), public network and public clients, private network and public clients, and strategic digital city.

Municipal Infovias, which are a public communication environment, provide several benefits for residents, such as fast internet access. In a more technical definition, the information highway is a public communication network with the purpose of satisfying the interconnection needs of municipal government and of facilitating universal access and digital inclusion for the entire population of the municipality, regardless of social class [26] – [19].

In the model of "public network concession", the network is built by the government through a bidding process. The government builds the network and the operation and maintenance are executed by a private company under legal concession. It is possible to rely on federal, state and development banks funds. Once the internet is installed, the next step is usually establishing a new bidding process for the concession of service delivery in a dynamics very similar to road concessions, including obligations and revenue sources for the predefined concession holders [18] - [19].

The IBM model simulates the creation of a city and allows governments to study the best ways to define public policies, predicting possible future effects. IBM along with the city of Portland teamed up to create a city simulator IBM program.

The Siemens model is placed as the largest supplier in the world of environmentally friendly technologies with an environmental portfolio that presents solutions for virtually all areas of production, transmission and consumption of energy (buildings, industry and lightning). It also has a worldwide history regarding the sustainability of cities through a series of studies Green City Index by SIEMENS.

The PNBL model of broadband internet connection is made available by TELEBRAS to telecommunication services providers under the National Broadband Plan - PNBL. Prepared jointly by the federal government and the municipal government, with the participation of the domestic industry, the project combines the use of optical fiber with WiMax by TELEBRAS.

The Strategic Digital City model is conceptualized as the application of information technology resources in the management of the municipality, as well as in the provision of information and services to residents or citizens. This is a broader project than just offering Internet services to citizens through conventional telecommunications resources. It goes beyond digital inclusion of citizens in the World Wide Web, since these comprehensive projects

ISSN: 2319-5967
ISO 9001:2008 Certified
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include information management systems for the municipal management and citizens, besides municipal safety systems [10].

Smart city projects plan and provide information, systems and services for their managers and citizens. The municipal Information planning requires the participation of municipal officials and citizens, including workers, students, retirees, housewives, councilors, businessmen among others. The strategic planning of the municipality, the municipal information planning and the information technology strategic planning are the prefectures and cities management tools of unquestionable relevance [9].

V. RESEARCH METHODOLOGY

Regarding the nature of the investigation, the scientific research methodology has been applied. As for how to address the problem, this research took a qualitative approach. But the research also has its quantitative side, of interpretative nature, from the analysis of the relations and integration of municipal and regional planning tools with the information systems and the information technology resources and their contributions to the city management. From the standpoint of its objectives, the study was exploratory and descriptive [22], [18], [19], [35]. On the other hand, from the point of view of technical research procedures, priority was given to case studies in the participant prefectures [18], [19], [1], [35]. Thus, semi-structured interviews, personal observations and the management and data organization techniques allowed the documentation of the quantitative and qualitative analyses. In addition to these two technical procedures, documentary research was also performed while examining material related to municipal and regional planning tools (municipal strategic planning, city master plan and multi-year municipal plan) found in the participating municipalities.

The research field was organized under two perspectives and two moments, i.e., two practical investigations. The first investigation was conducted by a pre-test and a pilot test [14] - [22]. The pre-test was conducted in three municipalities of the MRC.

Both activities were carried out using the preliminary questionnaire, the semi-structured interviews and the observations [1], for an initial analysis of these organizations. This allowed the development of the final questionnaire for the remaining part of the research and conclusive analysis. The second investigation was conducted by the survey [12], [18], [19], [1] performed in three municipalities of the MRC, which had previous experience with digital city projects, according to defined criteria of population and survey sample.

The samples were chosen to represent the "good judgment" of the information provided by municipal managers, representing the descriptive part of the survey [18] - [19].

As observation unit, it was decided to choose the 29 municipalities that compose the Metropolitan Region of Curitiba (RMC). Only the Information Technology Managers were considered, due to the convenience. Each one consulted Municipal Secretaries connected to municipal planning. Depending on the nature of the questions, at least three people in each municipality was directly and indirectly involved.

In some municipalities such as Pinhais, Almirante Tamandaré and São José dos Pinhais, the interviews were performed with the Information Technology Director, with the support of the Secretary for Planning and Urban Development and civil servants linked to municipal planning. This department serves as a support to all other departments, where the overall objective is to meet the PEM. Its biggest challenge is to assemble a team of trained professionals to meet the needs of the municipality.

In the municipalities of Quatro Barras, Lapa, Curitiba and Fazenda Rio Grande, the research was conducted by the survey method, due to the unavailability for the interviews. To answer the interview guide, the Information Technology and Communications Director that works in conjunction with the Department of Administration had the support of the finance and planning secretaries and related public servants.

The research analysis protocol represented as treatment to be used during its application as a tool for data collection provides a satisfactory level of reliability of the case study [1].

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The present analysis targets the presentation of the digital city projects identified at seven (7) municipalities in the Metropolitan Region of Curitiba (RMC): Almirante Tamandaré, Curitiba; Fazenda Rio Grande; Lapa; Pinhais; Quatro Barras and São José dos Pinhais. From a set of information, with different objectives that can describe these projects, a description of a set of steps that can be designed and implemented ([26], [27], [30] is presented.

The research outline determines what must be surveyed and what has to be analyzed [21] – [12]. For the data analysis to be feasible, it was necessary to investigate, substantiate and define the variables (or criteria) to direct and interpret the results. These variables are key parts of the research protocol and its constructs. The research protocol was divided into two constructs: Digital City and Digital City Projects. Each of the constructs was dismantled into variables. The Digital City construct with following variables: types of digital city projects, digital city projects implementation models, municipal issues within the digital city project, ways of implementing digital city projects, citizen participation in digital city project design. In the Digital City Project construct the variables are: Municipal Planning tools, information systems available on the Digital City project, municipal services offered by the Digital City project, knowledge management offered by the digital city project, information technology and telecommunications included in the digital city project, Human Resources Planning to support the digital city project and contribution to the management of the municipality.

The identification of evidences or information records about digital city projects in municipal planning documents: PEM, PG, PD, PPA, PEI/PETI, where the initiatives for digital city projects are recorded, service providers; percentage (or values) for the collection of information technology, information technology training for technicians of information technology; and information technology training for users (municipal servants). The Information Technology Resources. Information Systems. The identification of the records or presence in the Plans and Municipal Planning with the variables: Municipal planning tools, where the initiatives for digital city projects are recorded, presented in the municipal multi-year plan (PMMA), the municipal master plan (PDM), the Municipal Strategic Planning (PEM), Strategic Planning of information systems and information technology (PESITI), Human Resources Planning (HRP), alignment or integration between plans and municipal planning; and factors underlying the alignment or integration between digital city projects, the plans and the municipal planning. The contribution of digital city projects and of the information technology with the variable: way of contribution. Each of these variables substantiated by its respective authors.

The research outline determines what should be investigated and analyzed [28] - [35]. For the data analysis to be possible, it was necessary to research and define variables (or criteria) to direct and interpret the results. These variables are key parts of the research protocol, in which a relationship between the constructs and their variables with the authors that substantiated them, as well as the related questions used in the scripts. Each variable determined the kind of measurement. The tools for the research data collection were: data collection script; interview script, non-systematic observations and interviews. The scripts were organized and structured based on the theoretical foundations and experiences of the researcher. They were carefully analyzed by professors, researchers and municipal employees, to corroborate its reliability and potential utilization. They were structured in: city data, identification of the interviewee; open and closed questions divided into the constructs of the research protocol. The non-systematic observation consisted of recording the facts of reality, done spontaneously as the facts and research activities took place [1] - [22]. The observation unit for the interviews consisted of members of the digital city projects design team, including municipal employees and residents as well. The sample of the single case study was defined in terms of accessibility for convenience [1], [35], [31], [39] as a method validation and replication for the 6 participants and due to the existence of digital city projects in the municipalities studied.

The research protocol was divided into two dimensions: Digital City and Digital City Project. The Digital City dimension has only the construct "Types of Digital City Project", with the variables: digital city projects models; digital city projects implementation models, municipal issues within the digital city project, ways of implementing digital city projects: Citizen Participation in the Digital city project definition and the record or presence in the City Master Plan (PDC), in the city Multi-Year Plan (PMMA) and in the Municipal Strategic Plan (EMP), as well as its contribution to municipal management, through the provision technological tools to citizens, has five constructs: organization, dissemination and training, municipal strategic analysis; municipal strategic guidelines, strategies and municipal actions; municipal controls and digital city projects management. Municipal Planning tools cited: PEM, PG, PD, PPA, PEI / PETI, where the initiatives for digital city projects are recorded. The Digital City Project

ISSN: 2319-5967
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dimension also features the single construct "Services offered in digital city projects" with the variables: information systems available on the Digital City project, municipal services offered by digital city project, knowledge management offered by the digital city project, information technology and telecommunications contemplated in the digital city project, Human Resources Planning to support the digital city project and contribution to the management of the municipality. Each of these variables substantiated by its respective authors.

VI. ANALYSIS OF DIGITAL CITY PROJECTS IN SEVEN CITIES THAT MAKE UP THE METROPOLITAN REGION OF CURITIBA (RMC)

To introduce the analysis carried out by variables, the analysis criteria that guided the research parameters are presented. The analysis criteria were defined based on the literature review that are part of the research protocol and validated by means of diagnosis made in the municipalities that make up the Metropolitan Region of Curitiba (RMC).

A. Analysis of the municipalities of the Metropolitan Region of Curitiba (RMC)

Seven of the twenty-nine municipalities that compose the metropolitan region of Curitiba (RMC), complied with the research protocol variables and were analyzed, highlighting the existence of a digital city project: Almirante Tamandaré, Curitiba, Fazenda Rio Grande, Lapa ; Pinhais, Quatro Barras and São José dos Pinhais.
In the graph of the summary table of the municipalities that compose the metropolitan region of Curitiba (RMC), which complied with the research protocol variables, 24% of the municipalities met the minimum requirements of the survey, a total of 7 (seven), compared with 76 % of the municipalities that didn´t meet these requirements, or the others twenty-two.

VII. ANALYSIS OF THE TYPES OF DIGITAL CITY

Regarding the four constructs of the strategic alignment (IT, IS and SC, HR and CO), HR and CO, despite its requirement and necessity, were partially planned, are partially adequate and have ongoing projects to become fully adequate. The IT infrastructure still needs to be improved. The operational and managerial SI is adequate. The Strategic SI and the SC must be better planned and developed. The digital city project was partially adequate and planned, however, still under development and evolving.

The percentage of PETI and PEM alignment to the digital city project is low from the point of view of the interviewees (40 % on average).

Analysis performed on the variables of the construct "digital city", as shown in the research protocol analysis. In compliance with the following criteria: Controls prioritizing what to control and its responsible, with the following characteristics: Strategic with municipal objectives complying with the functions or primary municipal issues for the top administration, for tactical or managerial; for the strategies and municipal actions with functions or complementary municipal issues fulfilled by the managers and for the operational already described in the operational plans with function modules or municipal issues described by the technical staff.

A certain degree of information integration and verification was noticed, for example on the request. A diagnosis was performed, management and operational information were collected, the population was listened to, and from this point, it was defined what the municipality should do to own a digital city and how it would be operated and maintained in accordance with the following criteria: 100 % for the representative and significant presence. Taking into account all the principles of digital city projects, 75 % for great presence. Considering some design principles of the digital city, 50% with moderate presence. Some trends in digital design principles start to become evident; 25% with modest presence. Some trends in digital design principles start to be noticed and for 0% with null presence. Some trends in digital design principles start to be noticed.

According to the theoretical foundation, for the municipal e-services to obtain effectiveness, it is necessary that the information is integrated, either among the various city departments or among different areas of the same Council or even among other areas of other entities: federal and state. Making available through its presence in the digital city projects (CD) in the municipalities involved in the research, belonging to the metropolitan region of Curitiba (RMC).

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The integration of information should be made available to citizens, businesses and society as a way to facilitate and expedite the fulfillment of the needs of all stakeholders in e-services. In the 2009-2012 term data collection, it was made clear that the information was provided in an integrated manner only by a few sectors, moving towards greater and progressive integration.

Gradualism in the implementation of integrated information management was noted as, for example, the accounting was not yet integrated to the portal. Their statements and balance sheets were previously generated, saved in PDF format (Open Document read through an application provided by the manufacturer, holder of the copyright) and stored in the portal. That means that there was no generation of online statements and balance sheets [32] – [39].

Another case of perception of integrated information management and data recovery could be verified in the consultation of protocols, where after validating the identification; the user can check the rest of the data for visualization.

In the case of the issuance of a property tax duplicate, the user could view the registration data, from the municipal funding department. Declared integrations were reported for other areas, such as the civil and military police, and the Ministry of Health for the communication of care provided by the municipality.

In all the analyzed projects the adopted implementation methods were the information highways (infovias), with its local peculiarities, which are a public communication medium that provides many benefits for residents, such as access to high speed internet [30], [29], [39].

VIII. IMPLEMENTATION ANALYSIS

In technical terms, it can be considered as a Digital City project the data services and connectivity between public agencies and the various entities, which aim at providing different levels of modernization and troubleshooting trough communication. Through expansion and investment in new Information and Communication Technologies (ICTs) and emerging within the new public management by the increase of the efficiency and effectiveness in the delivery of services to citizens [5] – [6].

A. Template designs of digital city

There are several digital city projects that could be adapted to the economic and technological realities of each municipality, as well as the capture and subsequent release of funds from the States and the Federation, which are the public model, the concession model or the consortium model [5] – [6].
In this case, 100 % of the sample works with the public model of digital city project in accordance with the classification of MCTI - Ministry of Science and Information Technology.

B. Types of digital city projects

The Digital City project types: Municipal Infovias, public network and clients, public network and private clients, private network and public clients; Strategic Digital Cities, that aims at providing means for the modernization of public administration, interconnecting all offices of the city management, such as health centers, schools, call centers, departments and other public areas, thereby converting the municipality and thus providing an independent internet infrastructure, resulting in an immediate decrease in the spending with technical assistance and support and other third party services, in addition to providing new technological tools that will serve citizens in an agile and integrated way.
In this case, 100 % of the sample has the kind of digital City project of Municipal Infovias, according to the classification of MCTI - Ministry of Science and Information Technology.

C. Addressed Issues

One of the main objectives of a Digital City Project is to provide a new way to make some services available for citizens and municipal service managers, addressing the municipal issues.
As for its availability through existing technological tools and their respective services within the digital city projects in the towns of Almirante Tamandaré, Curitiba, Quatro Barras, Lapa, Fazenda Rio Grande, Pinhais and

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São José dos Pinhais some areas that were directly covered in this research become evident. Having municipal issues as: Administration, Education, Planning, Public Safety and Traffic with 1.40%, Finance with 1.0%, Health with 0.40%, Housing, Public Works, Human Resources and Transportation with 0.20 %, Utilities, Social Communication, Culture, Environment, Social, Labor and Employment, Sport, Recreation and Youth; Environment; Social; Labor and Employment; Tourism and Urban Planning with 0%.

Services were identified as: Internet for citizens at key points in the city, Citizen Portal, electronic invoice (NF –e), property tax with 100%, and Certificates - CND, Extracts, and Tax Deed –with 57.12 %; Protocol, Safety, Health and traffic with 42.84 %, HR - Paycheck, Public Works, Planning, Human Resources, Labor and Employment and Transportation with 28.56%, education, Ombudsman, Environment, Tourism and Urban Planning, with 14.28 %.

IX. ANALYSIS OF CITIZEN PARTICIPATION

In this analysis, we first sought to identify whether there was public participation in any phase of the project revealing how such participation occurred. Here, 100 % of the analyzed sample shows no public participation in relation to decisions or suggestions for the digital city project and all municipal affairs.

X. CONCLUSION

The gaps between the municipal and regional innovation planning tools, the information systems, the knowledge innovation management practices, and the information technology resources and municipal management were considered. In addition to its failure factors and difficulties in implementation, support the need for a field study to assess the current situation of the Brazilian municipalities.

Because of what has been occurring in recent decades as the evolution of public administrative procedures automation, both in its availability through specific technological tools and through the Information Technology and Communication (ICT), this type of research is buoyed by the digital city projects models.

Responsible for updates and new presentation format and for making available in several Brazilian cities, with regard to the improvement of the delivery of essential public services, to assist in the Management of Public and Municipal Administration, therefore innovating not only regarding the relationship, but also with the effective delivery of these public services for citizens [26] – [23].

The purpose of this research, is to address the issue, discussed in the surveyed municipalities "How do digital city innovation models and city and regional planning tools (municipal strategic planning, the municipal master plan and multi-year municipal plan) integrated with the information systems, knowledge management practices and the information technology resources, can contribute to the management of municipalities and prefectures?"

Using a research protocol, it was possible to adopt a logical sequence, to the extent that the added variables, sub - variables (sequence of events), the analysis criteria (measurement unit grounded on the theoretical structure) and authors that were used as base. In the methodological approach, the choice of the case study as the research method, allowed a more thorough and detailed study of the cases of the municipalities of the metropolitan region of Curitiba (RMC) that fulfilled the requirements of this research and of the quantitative and qualitative approach and qualitative that was used in an attempt to analyze the presence of variables and their manifestation in the counties and the municipalities studied.

It is important to note that in the detailed analysis, variations were identified regarding the prevalence of some variables as well as the absence of such in some municipalities. These factors did not affect the final average of the results obtained, so that the innovation city administration was classified as a management marked by some presence in the principles of digital city projects.

According to the Ministry of Science and Technology, for the effective implementation of a digital city project some assumptions should be followed. The first relates to the license of use, being a telecommunications service it is mandatory to follow the guidelines imposed by ANATEL - National Telecommunications Agency. There are two possibilities in this regard, hiring a telephone operator company, although this alternative is often not possible due to economic interests, seeking the services of third parties, or creating your own network.

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In the case of using Third Party Services it is necessary to hire a public or private company, holder of a license for Multimedia Communication Service (SCM) allowing the economic exploitation of the network. For the implementation of an own structure, it is necessary that the municipality request to ANATEL a license for the private network services, in the sub modality of Private Limited Service (SLP). This license allows you to meet the demands of the municipality for services related to education, culture and information through a portal access or internal site of the prefectures. The second possibility is the definition of the technologies that will be implemented and available sustainability models.

We can also conclude that this approach is the result of the movements of the digital city projects that occurred in the decades of 1990, 2000 and 2010. So, we emphasize that in the prefectures and municipalities of the MRC, digital city projects not always consisted of a concern that the decade of 1990-2000 there was after 2005 with the significant decrease of the telecommunications infrastructure costs, as well as a better understanding of the scope of the digital city projects, which provided a qualitative leap in the scope of these digital city projects.

Therefore, it can be verified that this more complete study and relying on pre-existing digital city models allowed the determination of the variables from the point of view of the presence of their manifestation as showing that there are important aggregate contributions in the management and provision of technological tools aimed at providing a new form of interaction between municipalities and citizens [18] - [23].

As for the proposal of procedures for data collection in relation to the research protocol, the qualitative approach for the deepening of the variables manifestation study, regarding their presence or absence and the quantitative approach with the adoption of specific criteria for accreditation or not in order to take part in the studied sample. The classification of the type or class of digital city project and its contribution to the studied cities management was allowed, and will be able to be implemented as a parameter for additional research, as, for example, the comparative analysis among other counties and its contribution during the implementation of a Digital city project in the administration management in municipalities similar to those selected municipalities that are part of the Metropolitan Region of Curitiba (RMC). As can be seen in chapter IV analysis of digital city projects in seven cities that make up the Metropolitan Region of Curitiba (RMC).

Finally, in the analysis of existing digital city projects, by checking the sequence of events (variables and sub-variables) throughout the innovation process of analysis of its contribution in municipal management. In all surveyed municipalities, along with a detailed variable analysis, it was noted that when these projects exist, the availability of a technological tool set is confirmed, and necessary for a modern, agile and concerned about prompt citizen service and satisfaction.

This research had as its main goals the diagnosis of ways and models of digital city projects in the Metropolitan Region of Curitiba (RMC). To reach this goal, a case study was conducted in the municipality of Pinhais, supported by the research protocol, consisting of variables and sub-variables, the theoretical criteria (benchmark analysis), and its supporting authors, as well as by the theoretical basis of the topics Digital City and Planning and interrelation of Digital City Projects. Regarding the first specific goal, or the diagnosis of ways and models of digital city projects in the Metropolitan Region of Curitiba (RMC), it can be stated that it was achieved as shown, with descriptive and qualitative analysis of all variables in the selected municipalities and quantitatively by the identification of the presence innovation of all variables in each selected municipality that composed the studied sample. The first operational or secondary goal, which consisted of contacting the adoption of concepts (and their respective components) about "Digital Cities", technological and municipal management tools, where the resultant analysis followed the same reasoning of the first goal. Demonstrated by the descriptive and qualitative analysis of the expression of each variable in all studied municipalities of the Metropolitan Region of Curitiba - RMC, which belong to the sample and quantitatively regarding the presence of each variable in these municipalities. Regarding the second or secondary operating goal, a comparative analysis was performed by examining how these projects contribute in the management of public services, based on the universalization of access, quality and integration, contributing to the Municipal Public Management. And finally, the third operating or secondary objective, the documentation of the practical application of the information technology resources in the planning and management of cities in urban municipalities that make up the Metropolitan Region of Curitiba (RMC) using digital city projects.

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The research contributes to fill a void in regard to the understanding and the theoretical foundations related to the subject of digital cities. Similarly, in the absence of specific publications that contribute to the public sector, in the sense that it can be used as a support and reference material for the managers responsible for the implementation of digital city projects.

The expected results for a digital city project, correctly implemented, will be reflected in the various sectors of society. In Government: the improvement of public administration, with the possibility of integration of the different departments of the administrative structure, the increase in tax revenue, more immediate access to services, VoIP communication. In Citizenship: installation of reduced costs telecenters, the dissemination of terminals for queries and complaints from citizens, access to the Internet, the production of knowledge. In the media: the democratization of information and communication, the implementation of the Municipal TV, online newspapers and radio stations, blogs. In Education: integration of schools, the online library, training of teachers. In Health: the likelihood of an integrated management of health care centers, interconnection with emergency services such as Fire Departments and Civil Defense, the use of new technologies such as telemedicine and videoconferencing. In economic terms: the wireless internet access for small business, cheaper communication with professional associations (or Unions) or entrepreneurs from other cities through VoIP communication, attracting technology companies, and workforce specialized in new technologies, generation of employment opportunities and income in the technology market. In the cultural field: production of digital videos and audios, promotion of cultural activities, integration with other culture related actions in the State. These are just some of the most important aspects of a digital city project.

When Brazilian municipalities receive the necessary technological support, regarding the implementation of the overall concept for the implementation of digital city projects, they will have at their disposal a strategic tool kit, towards the innovation public management in the areas of education, public health, connectivity and reorganization of procedures [16], [23], [39], [32]. Targeting to assign intelligence to the information generated by the systems and to provide the necessary infrastructure to enable a truly integrated management.

As for limitations, due to the inability to have a closer contact with managers, the servants and the citizens of the seven studied municipalities on a daily basis, it resulted in a data collection based solely on questionnaires and interviews. Due to the different strategies and some restrictions of certain responsible it was not possible to obtain more detailed information in some studied cities. Although the generalization of case studies has a series of constraints due to the results by sampling, that in the present case is small, the steps can be followed regardless of the peculiarities of the municipalities. However, the search for best practices should be performed, taking into account the profile of these municipalities, its technological infrastructure and the level of ownership and use of ICTs.

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