Australian Journal of Basic and Applied Sciences, 9(11) May 2015, Pages: 863-872

ISSN:1991-8178

Australian Journal of Basic and Applied Sciences

Journal home page: www.ajbasweb.com

Economic Development Analysis for Smart Cities: A New Approach for Management and Innovation Practices

[1]Hugo Ferreira Braga Tadeu, [2]Jersone Tasso Moreira Silva, [3]Rafael Pillon

[1]*Fundação Dom Cabral, FDC. Innovation and Entrepreneur Center, Rua Bernardo Guimarães, 3071 – Santo Agostinho – Belo Horizonte, MG. 30140-083. Brazil*
[2]*Invited Researcher, Fundação Dom Cabral, FDC. Innovation and Entrepreneur Center. Professor and Researcher, Business Administration Graduate Program, FUMEC University, Av. Afonso Pena, 3880. Bairro Cruzeiro, Belo Horizonte, MG, CEP. 30130-009, Brazil*
[3]*PUC Minas. Avenida Dom José Gaspar, 500. Coração Eucarístico, Belo Horizonte. CEP. 30.535-901*

ARTICLE INFO

Article history:
Received 16 March 2015
Accepted 28 May 2015
Available online 22 June 2015

Keywords:
PICAM, Smart City, Economic Development, Innovation, Cross Section Analysis, Monte Carlo Simulation

ABSTRACT

Background: Urban planning is the process of idealization, creation and development of solutions to improve or revitalize certain aspects within a given urban area or planning a new urban area in a given region, with the main objective to provide people with an improvement in life quality. **Objective:** The objective of this article is to point out ways to possible scenarios and solutions to facilitate the use of best management practices and innovation to overcome the future challenges for public managers of Porto Alegre City, Brazil. **Results:** Observing the growth rates of public investment in infrastructure and non-infrastructure, as well as the quantitative results we have that the city of Port Alegre is targeting public investments in a contrary way to what refers conceptually to Smart Cities. **Conclusion:** Low investments in infrastructure and non-infrastructure followed by the rise in law enforcement expenditure inhibit the entry of private investment and consequently economic growth for the city.

© 2015 AENSI Publisher All rights reserved.

To Cite This Article: Hugo Ferreira Braga Tadeu, Jersone Tasso Moreira Silva, Rafael Pillon, Economic Development Analysis for Smart Cities: A New Approach for Management and Innovation Practices. ***Aust. J. Basic & Appl. Sci.,*** *9(11): 863-872, 2015*

INTRODUCTION

Urban planning is the process of idealization, creation and development of solutions to improve or revitalize certain aspects within a given urban area or planning a new urban area in a given region, with the main objective to provide people with an improvement in life quality.

According to Aoun (2013), in less than 40 years, 70 % of the world´s population will be living in cities. The rapid migration will cause pressures not only on urban planners, but also on public administrators, as these should expand the infrastructure for industrial and residential areas beyond the break-even point. Thus, increasing the population´s expectations for a smarter city.

Smart cities are the paradigm of proper planning not only to the field of urban development, but also to innovation management. According to Komnino (2009), in the urban development field, intelligent cities supports the growth of local knowledge and in the field of innovation management ensures the sustainability of global innovation network. These two serves as connection to turn public institutions into innovative institutions to face the challenges of regional and global competition.

The last decade has seen the rapid conceptual evolution of what used to be called "technological cities" for now "digital or smart". The concept evolution correspond to the cities development with strategic mission focused not only on innovation and creativity, but also with economic focus and opportunities for society. The concept leads to an integrated and sustainable city (Yigitcanlar, 2007; Martinez- Fernandez and Yigitcanlar, 2007).

Smart cities essentially allow and encourage all citizens to become more active and participative as community members through a strong technological infrastructure. For that there are four key aspects with strong informational driver as: a) modern digital infrastructure that combines an open and transparent public database; b) intelligent systems to generate services based on data for the user to make strategic analysis of investments in the city; c) systems that allow the user to compare the results and performance generated by the data; d) openness to learning and exchange of experiences through new

Corresponding Author: Hugo Ferreira Braga Tadeu**.** Fundação Dom Cabral, FDC. Innovation and Entrepreneur Center, Rua Bernardo Guimarães, 3071 - Santo Agostinho – Belo Horizonte, MG. 30140-083. Brazil,
E-mail: hugo.tadeu@fdc.org.br

arrangements and simulation of mathematical models available to society .

Thus, the purpose of this article is to point out ways to possible scenarios and solutions to facilitate the use of best management practices and innovation to overcome the future challenges for public managers of Porto Alegre City, Brazil. The results will help to assist for a better investment strategic assessment by the local government, as well as to help users to compare better macroeconomic variables performance for the given period.

Therefore, a quantitative research was used which consisted of two steps as the first being the analysis of growth rates behavior for the variables considered relevant to ensure competitiveness, followed by a macroeconomic analysis using the *Private Investment Cross Analysis Mothodoly (PICAM).*

This study is the result of a research conducted by the Entrepreneurship and Innovation Center of Fundação Dom Cabral with the support of IBM and participation of representatives of Porto Alegre's municipal government using the competitiveness data, which were based on the nations competitiveness methodology used by the World Economic Forum, for the period 2004-2014.

This paper is structured initially with an introduction followed by methods and materials. The third section shows the main results discussed on the topics listed above and then the conclusions.

MATERIALS AND METHODS

Private Investment Cross Analysis Methodoly (PICAM) provides a cross section analysis among the variables determining the public / private investment with the macro and microeconomic variables that affects the sectors, as well as the intersection between the sector and analyzed subsectors (Tadeu & Silva, 2014a), Tadeu & Silva, 2014b ; Tadeu & Silva, 2013a, Tadeu & Silva, 2013b).

The quantitative data were obtained through DATAPOA and public database available based on IBGE (Brazilian Institute of Geography and Statistics), IPEA (Institute of Applied Economic Research) and Brazilian Central Bank Reports for the 2004-2014 period. This period was used because of the city´s data base availability. The obtained data are in millions of Real and were deflationed at 1995 prices.

Three questions were used to approach the quantitative research:

- What is the current economic environment for a short-term assessment for public management?
- What are the determinants for investment in the public sector?
- What are the short and long term challenges for the public administrators of Porto Alegre to the level of investment to achieve the standard of Smart Cities?

The competitiveness data used for the city of Porto Alegre were: Public Investment; Municipal GDP; Investment in Infrastructure (Environmental Management, Energy and Urban Planning, Communication and Sanitation); Investments in non-infrastructure (health, culture , sports and leisure); Public Budget; Subsidies; Expenditure on education; Expenditure on criminality; Expenditure on Justice; Expenditure on Urban Mobility; Expenditure on R & D and training.

Analytical model: Private Investment Cross Analysis Methodology (PICAM) and Fixed Effects Coefficients for Porto Alegre City Public Investments:

The proposed econometric model is directed towards the city of Porto Alegre public investment and combines the use of a set of data associated with economic performance observing the variables behavior related to competitiveness.

The methodology presented here is divided into two sections with the presentation of the theoretical model describing the econometric model for panel data and the second presenting the Analytical Model with application of the cross-section model and fixed coefficients for the city's public investment.

Cross Section Model and Variables Definition:

This section initially refers to the use of cross section model and longitudinal data. The first used econometric model is intended to test the macroeconomic data that may have an inhibitor impact on Porto Alegre´s public investment.

In order to explain the effects of economic variables on public investment in the city of Porto Alegre the following variables to the functional model were chosen:

- Invest_pub = f(r, GDP,PIB, Invinfra, Invninfra, Inflation) (1)

where:

- R = Real Interest Rate
- GDP = Gross Domestic Product.
- INVPUBINFRA = Public Infrastructure Investments; investments in electricity and urban planning, environmental management, telecommunications and sanitation.
- INVPUBNINFRA = Public Investments in non Infrastructure; investments that are not related to infrastructure, such as health, sport and recreation and culture.
- Inflation = inflation in the city of Porto Alegre.

From the general econometric model, we propose a natural logarithm model for public investments for the period 2004 - 2014, so to review the elasticities in the long-run, in other words the values will be transformed into rates:

- $LogInvest_pub_t = \beta_0 + \beta_1 LogR + \beta_2 LogGDP_{it} + \beta_3 LogINVPUBINFRA_{it} + \beta_4 LogINVPUBNINFRA_{it} + \beta_1 LogInflatrion + \varepsilon_t$ (2)

Growth Rates:

With the data generated by EQ. 2 it is possible to analyze the growth rates behavior of the selected variables for the competitiveness variables of Porto Alegre, as these are expressed in natural logarithm.

For this step will be generated 12 graphics for the city of Porto Alegre, these being:

• Public Investments Growth Rates;
• GDP Growth Rates;
• Investment in Infrastructure Growth Rates;
• Investment in Non-Infrastructure Growth Rates;
• Public Budget Growth Rates;
• Subsidies Growth Rates;
• Expenditure on Education Growth Rates;
• Expenditure on Criminality Growth Rates;
• Expenditure on Justice Growth Rates;
• Expenditure on Urban Mobility Growth Rates;
• Expenditure R&D Growth Rates;
• Expenditure on Training Growth Rates.

Cross-Section between public investment variable and macro variables:

The following four equations will be estimated to evaluate the impacts of the proposed variables for public investments.

The four estimated questions are determined as follows:

- Equation 1: LnInvest_pub= f(LnInfra, LnnInfra, LnGDP, LnR, LnInflation)
- Equation 2: LnInvest_Infra= f(Ln environmental management, LnEnergy_Urbanism, Ln telecommunications and sanitation)
- Equation 3: LnInvest_nInfra= f(LnHealth, LnCulture, LnDesporto_Lazer)
- Equation 4: LnInvest_nInfra= f(LnHealth, LnCultura, LnSport_Recreation, LnCriminality, LnJustice, LnEducation, LnR&D, LnTraining)

Results:

This session presents the results analysis of the growth rates competitiveness variables, as well as the econometric analysis for the PICAM.

The results are divided into three stages in order to analyze the behavior of the studied parameters as follows:

I. Analyze the growth rates for the competitiveness variables:

i. Macroeconomic variables for Porto Alegre: Public Investment; GDP, Infrastructure; No Infrastructure; and

ii. Government Variables for Porto Alegre: Budget, Subsidies, Criminality, Justice, Education, Research and Development, Training and Urban Mobility.

II. Analyze Public Investment Cross-Section results for the city of Porto Alegre.

III. Analyze the Cross-Section of the Public Investment for the sustainability variables such as environmental management, energy and urban planning and communication and sanitation.

Stage 1: Growth Rates Variables Behavior of Porto Alegre´s Cross Section Model:

This stage is divided into two parts as the first being the analysis of macroeconomic variables and the second the public administration variables for the city of Porto Alegre.

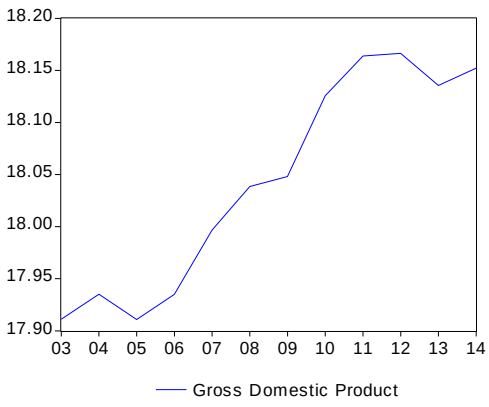
Porto Alegre´s Macroeconomic Analysis:

Graph 1, below, shows the behavior of the public investment growth rate for the city of Porto Alegre. It is observed that public investment showed high growth rates over time highlighting the period 2008-2012.

Graph 1: Public Investment Growth Rate.

The period shown above refers to the global financial crisis that demanded an increase in government investments to ensure life quality and secure municipal economy at appropriate levels.

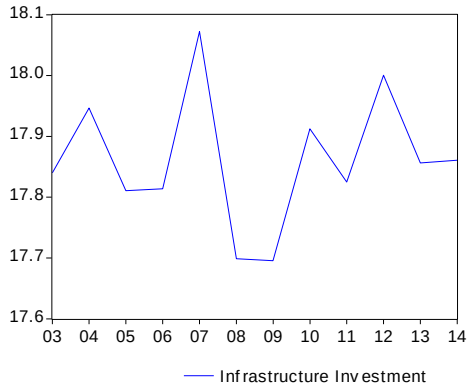
Graph 2 shows the Gross Domestic Product (GDP) growth rate generated by the city of Porto Alegre. The results indicate that there was an increase in GDP through the period 2005-2012.



Graph 2: Gross Domestic Product (GDP) growth rate.

The growth in GDP in the period can be explained by the increase in public investment presented in Graph 1. However, it is observed that the GDP growth rate has a smoother behavior compared with the behavior of public investment growth rate. It is suggested that public investment had to be higher to generate a reaction in GDP growth.

Graph 3 shows the growth rates for investments in infrastructure in the city of Porto Alegre. The results show variations in the growth rates for investments in infrastructure over the analysis period.

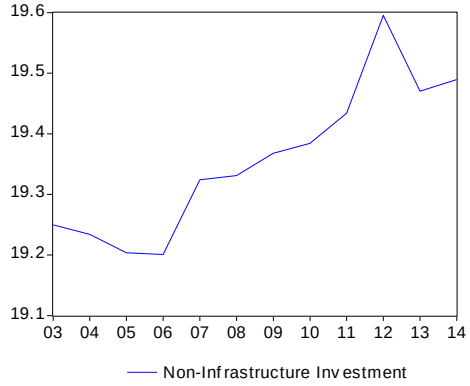


Graph 3: Infrastructure Investments Growth Rates.

The period with the highest drop in infrastructure investment was in 2007 to 2009. After 2009 investments grew, but with new fall in 2011.

As mentioned before, infrastructure is seen as the pillar to ensure competitiveness and attract private investment to the cities. But, what worries is that investment levels are lower than necessary reaching, in 2014, similar levels to 2003.

Graph 4 shows the results for the public investment in non-infrastructure growth rate. The graph shows two stages where the first one represents a decrease in the level of investments throughout the period from 2003 to 2006 and the second that shows a constant growth after the year 2006 to 2012.

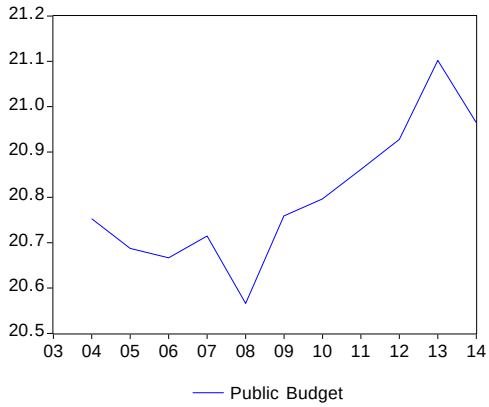


Graph 4: Public Investment in Non-Infrastructure Growth Rate.

The graph shows a peak over the period 2011-2012, but lowered investments right after reaching levels close to 2011.

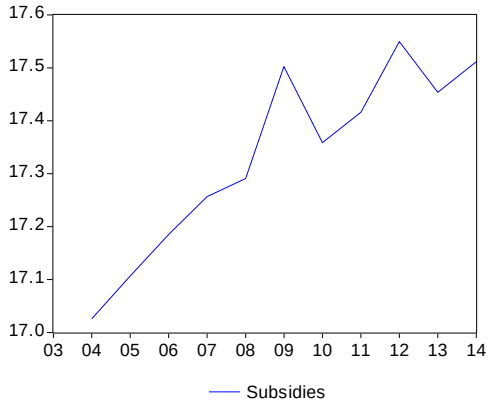
Porto Alegre's Public Administration Variables Analysis:

Graph 5, below, represents the growth rate behavior for Porto Alegre's public budget variable. The graph shows that the public budget growth rate reached its lowest level in 2008. After 2008 the growth rate rises considerably over time, reaching the highest level in 2013. The results are explained because of the increase in public investment and GDP growth presented in Graphs 1 and 2, respectively.



Graph 5: Public Budget Growth Rate.

Graph 6 shows the growth rate for subsidies. The results show a variation in growth rate over the period analyzed and compared with other rates it is perceived that such behavior does not follow a pattern if compared to other variables.

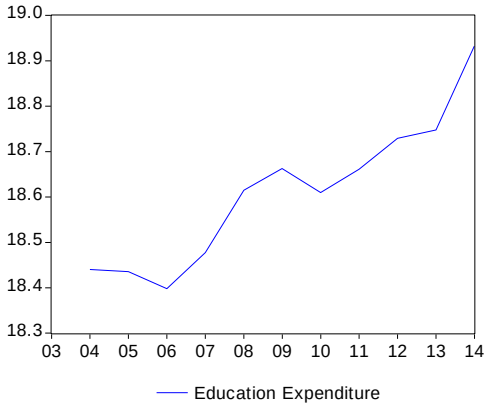


Graph 6: Subsidies Growth Rate.

The subsidies growth rate is increasing and constant over the period 2004-2008. The two fallen moments occurred in 2009 and 2012. The period 2010-2012 may represent an increase in subsidies because of the strategy to attract the private sector

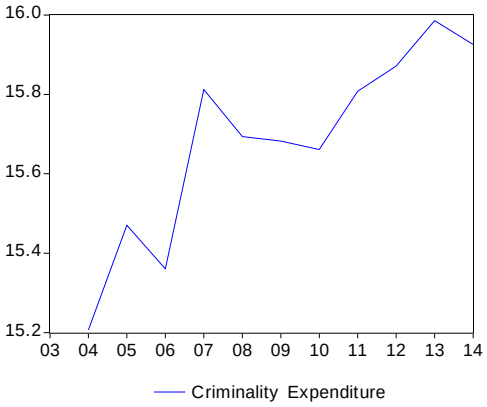
based on private-public-partnership (PPPs) and as a result raised the GDP growth rate.

Graph 7 shows the expenditure on education variable behavior for Porto Alegre. Is observed that over the 10 years analysis the growth rate has been increasing representing the public managers political commitment in improving education in the city.



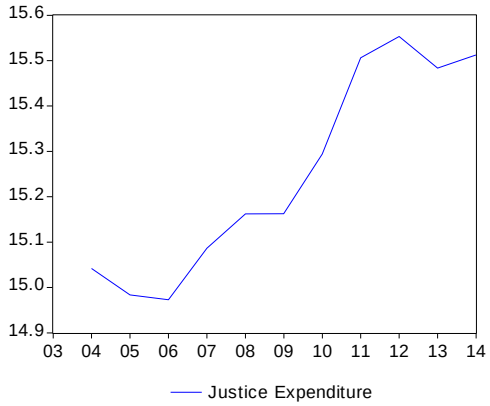
Graph 7: Education Expenditure Growth Rate.

Graph 8 shows the growth rate for the variable expenses with crime. The graph shows higher growth rates if compared to the growth rate on education expenditure. This is a chronical problem for the Brazilian cities, where the expenditure with police enforcement (expenditure with criminality) become the political platform for current and future public managers.



Graph 8: Expenditure with Criminality Growth rate.

Comparing Graphs 8 and 9 we observed the amount of money that the city of Porto Alegre has spent with law enforcement. Graph 8 and 9 have shown abrupt increase on expenditures over time.

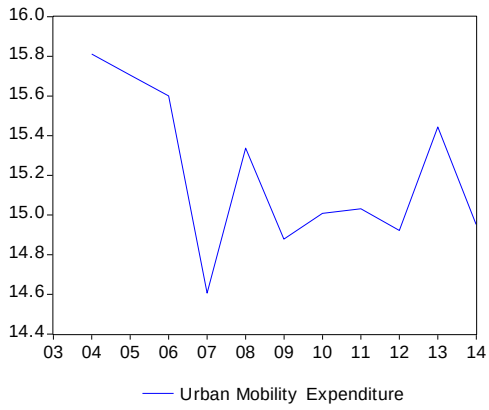


Graph 9: Justice expenditure growth rate.

The concept of smart city presented in the introduction shows that smart cities begins with intelligent systems that work for the populations benefit and environmental sustainability. Infrastructure, as well as public and private transport systems, health, research and development, and training are critical points to promote the city's efficiency. These critical points should be improved and integrated to the city's system transforming it into a real model to increase the population's life quality.

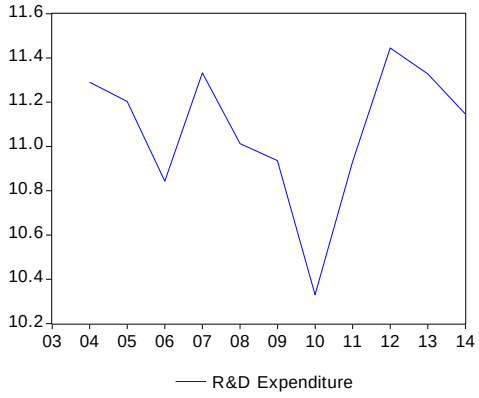
Analyzing the Porto Alegre's critical points, we observed that due to a political commitment public budget is mainly directed to expenditure on law enforcement, therefore, there has been a fight for scarce financial resources assessment among the other areas with worried reflexes according to Graphs 10, 11 and 12.

Graph 10 shows the growth rate of expenditure on urban mobility. The graph shows an inefficient urban transportation system with little public investment and that can discourage private investment to installing industries and businesses in the city, as well as hinders the mobility of society to schools, training centers, hospitals and medical clinics.



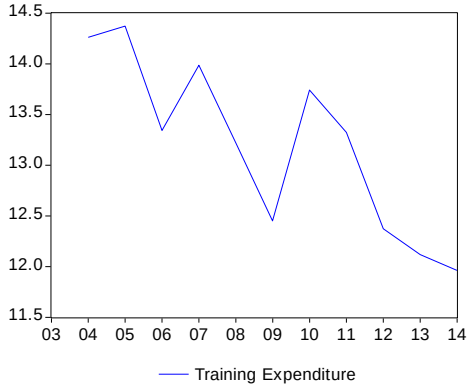
Graph 10: Urban Mobility Growth Rates.

Contrary to what is understood as a smart city the results indicate low growth rates in Research & Development (R & D), as shown in Figure 11. The R&D investments results are seen as long-term, and this should be increasing over time rather than abrupt investments as shown in the years 2010-2011.



Graph 11: R&D Growth Rates.

The most concerned graph analyzed up to now is Graph 12.



Graph 12: Training Expenditure Growth Rate.

The results indicate a decrease on training expenditure, which in the long-run can have serious consequences as to public personnel with low productivity and a society unprepared for a possible expansion on private sector investment as in general. This, without considering the green belt that supplies the city of Porto Alegre.

Macroeconomic analysis for the city of Porto Alegre:

This section is divided into 3 parts with an initial analysis of Porto Alegre's government investment equations, using the Cross-Section with Fixed Effects Method for the period of 2004-2014, followed by the government investments in infrastructure equations analysis and finally, the government investment equations in non-infrastructure analysis.

The results in Table 1 indicate a positive relationship between public investment in infrastructure (LogINVPUBINFRA) and public investment, that is, if there is a 1% increase in public investment in infrastructure will cause an increase in public investment of 1.27%. This behavior is maintained throughout the tested equations.

Equation 2 shows the results with the inclusion of the variable public investment in non-infrastructure, which suggests a positive relationship regarding the impact on public investment in the city of Porto Alegre. This behavior is maintained throughout the tested equations. The Equation 2 showed an overall satisfactory degree of explicability with $R^2 = 0.76$.

In the case of Equation 3 it is observed that the Porto Alegre's Gross Domestic Product has a positive effect on the increase in public investment once the GDP allows to estimate the generated wealth and identify their specific composition contributing to public policy formulation.

Table 1: Government Investments Equations for the city of Porto Alegre, RS, using the Cross Section Model with Fixed Effects for 2004-2014 period.

Explained Variables[(1)]	EQ1	EQ2	EQ3	EQ4	EQ5
C	-4.6962	-27.9184	-37.7259	-52.4049	-54.7938
	[-2.0690]	[-14.9949]	[-18.3178]	[-11.9593]	[-11.9278]
	(0.0499)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LnINVINFRA	1.2775	0.6451	0.8044	0.8276	0.8582
	[10.0742]	[7.6807]	[10.5428]	[11.1698]	[11.2877]
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
LnINVNINFRA		1.7835	0.0446	0.3448	0.3817
		[18.4623]	[0.1868]	[1.4102]	[1.5619]
		(0.0000)	(0.8520)	(0.1601)	(0.1199)
LnGDP			2.2505	2.7085	2.7732
			[7.7858]	[8.8780]	[9.0568]
			(0.0000)	(0.0000)	(0.0000)
R				0.0279	0.0299
				[3.7615]	[3.9941]
				(0.0002)	(0.0001)

Inflation					-0.0096
					[-1.6586]
					(0.0988)
R^2	0.3411	0.7602	0.8173	0.8298	0.8322
Adjusted R^2	0.3377	0.7577	0.8145	0.8262	0.8278
S.E.R.	0.2457	0.1486	0.1300	0.1258	0.1253
DW stat	0.8294	1.5456	1.8457	2.0168	1.9265

Obs: (1) Statistics-t in brackets, followed by p-values in parenthesis.

The real interest rate (R) showed a positive signal in Equation 4 meaning the use of own resources for public investment, despite the value estimated to be close to zero. Another understanding lies in the fact that the interest rate does not interfere with public investment resources. Equation 4 shows an overall satisfactory degree of explicability with R^2 = 0.82.

Finally, Equation 5 estimates the influence of inflation on public investment and consequently the result of a complete macroeconomic model for the city of Porto Alegre. The results show that there was no change in the signs on the estimated variables indicating the importance of public investment in infrastructure and non-infrastructure, as well as GDP. On the other hand, despite the relatively insignificance interest rate and inflation that do not influence public investments. Equation 5 shows an overall satisfactory degree of explicability with R^2 = 0.83.

Table 2 shows the behavior of Environmental Management, Energy and Urbanization, and Communication and Sanitation expenditures for public-sector investment in infrastructure in the city of Porto Alegre.

Table 2: Government Investment Equations in Infrastructure in the city of Porto Alegre, RS, by the Cross-Section Method with Fixed Effects for the period 2004-2014.

Variáveis Explicativas(1)	EQ1
C	-0.8571
	[-0.6203]
	(0.5385)
Ln_ Environmental Management	0.1359
	[1.9213]
	(0.0618)
Ln_Energy_Urbanization	0.6779
	[15.4690]
	(0.000)
Ln_Comunication_Sanitation	0.2941
	[14.0194]
	(0.0000)
R^2	0.8998
Adjusted R^2	0.8923
S.E.R.	0.0457
DW stat	2.0121

Obs: (1) Statistics-t in brackets, followed by p-values in parenthesis.

The results in Table 2 indicate a positive relationship between all variables that compound public investments in infrastructure. Investments in infrastructure promote improvements in the environment for private investment, urbanization, sanitation and environmental sustainability. Infrastructure promotes economic growth for the city, as well as increase the personal wealth and the demand for a better and infrastructure quality. The results show an overall satisfactory degree of explicability with R^2 = 0.89.

Table 3 shows the behavior of health, culture, and sports and leisure expenditures in relation to public investment in non-infrastructure of Porto Alegre.

Table 3: Government Investment Equations in Non-Infrastructure in the city of Porto Alegre, RS, by the Cross-Section Method with Fixed Effects for the period 2004-2014.

Variáveis Explicativas(1)	EQ1
C	0.2573
	[35.9173]
	(0.0000)
Ln_Health	0.9428
	[2327.070]
	(0.0000)
Ln_Culture	0.0421
	[66.6048]
	(0.000)

Ln_Sports_Leisure	0.0146
	[[0.9488]
	(0.0000)
R^2	0.9999
Adjusted R^2	0.9999
S.E.R.	0.0001
DW stat	2.5559

Obs: (1) Statistics-t in brackets, followed by p-values in parenthesis.

The results in Table 3 indicate a positive relationship between all variables that compound public investments in non-infrastructure. Investments in non-infrastructure promote a better quality of life, citizenship concern and decreases criminality. The city of Porto Alegre do not invest the necessary amount of money to guarantee acceptable levels of services on helath, culture and Sports and Leisure. The results show an overall satisfactory degree of explicability with R^2 = 0.99, despite the low coefficient values.

Table 4 presents the estimated complete model as to the behavior of public accounts in relation to public investment in non-infrastructure of Porto Alegre City. Therefore, we included, in addition to public expenditure contained in Table 3, the expenditures with law enforcement (police and justice), education, R&D and training for the 2004-2014 period.

The complete model presented in Table 4 indicates a clear disproportionality in public spending in the city of Porto Alegre, for expenses such as Health, Culture, Sports and R & D, despite showing a positive relationship, represents a small share values in public investment in non-infrastructure. On the other hand, expenditures Justice, Education and Training has shown significant and positive behavior. Expending on criminality has shown negative behavior represented with disinvestment in non-infrastructure. The results show an overall satisfactory degree of explicability with R^2 = 0.99.

Table 4: Complete Government Investment Equations in Non-Infrastructure in the city of Porto Alegre, RS, by the Cross-Section Method with Fixed Effects for the period 2004-2014.

Variáveis Explicativas(1)	EQ1
C	0.2359
	[123.1218]
	(0.0000)
Ln_ Health	0.9430
	[6959.321]
	(0.0000)
Ln_Culture	0.0433
	[382.6180]
	(0.000)
Ln_Sports_Leisure	0.0150
	[140.5742]
	(0.0000)
Ln_Criminality	-0.0008
	[-24.1831]
	(0.0000)
Ln_Justice	7.6135
	[1.4029]
	(0.1645)
Ln_Education	7.6895
	[1.4275]
	(0.1574)
Ln_P&D	0.0002
	19.0165
	(0.0000)
Ln_ Training	9.4588
	[13.3943]
	(0.0000)
R^2	0.9999
Adjusted R^2	0.9999
S.E.R.	2.5689
DW stat	3.0438

Obs: (1) Statistics-t in brackets, followed by p-values in parenthesis.

Observing the growth rates of public investment in infrastructure and non-infrastructure shown in the first results session Step 1, as well as the quantitative results in the results presented in the second session we have that the city of Port Alegre is targeting public investments in a contrary way to what refers conceptually to Smart Cities. Low investments in infrastructure and non-infrastructure followed by the rise in law enforcement expenditure inhibit the entry

of private investment and hence economic growth for the city.

Conclusion:

This paper suggests that there are possibilities to manage the cities with innovations in processes and consequently in technology. Much more than investor in intelligent systems, a city becomes intelligent from investments in infrastructure, non-infrastructure, education, justice and others. It is also suggested that the relationship between increases in subsidies and the quality of public spending, measured by the budget, would have a strong impact on improving the quality of life and economic growth.

The article´s contribution is the use of an economic analysis model, evaluating the available data and impacts on public management, something not seen in the literature review on smart cities.

For future studies, we suggest to run a Monte Carlo Simulation which is a method that associates maximizing, minimizing and the risk calculation for the variables under study. In other words, searching up with the method, the simulation (historical attempts) quantities, the error can be predicted. The essential feature of Monte Carlo simulation is the use of sampling techniques through discrete variables and the search for solutions with the use of differential equations.

We also suggest obtaining data from other cities, seeking to achieve consistent analysis and their interpretation in search of improvements on public management, innovation and government intelligence.

REFERENCES

Aoun, C., 2013. The Smart City Cornerstone: Urban Efficiency. Schneider Electric White Paper.

Aysan, A., G. Pang, M.A.V. Varoudakis, 2004. How to boost private investment in the MENA countries: The role of economic reforms. Journal of Economic Literature, 7: 1-15.

Chirinko, R.S., 1993. Business fixed investment spending: modeling strategies, empirical results, and policy implications. Journal of Economic Literature, 31: 1875-1911.

Dickey, D., W.A. Fuller, 1981. Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49: 1057-1072.

EPE, 2012. Balanço Energético. Accessed on Jul 12, 2012, at http://www.epe.gov.br

Ferreira, J.M.G., 2005. Evolução dos investimentos no Brasil: Uma análise econométrica. Dissertação de Mestrado, FGV-SP, pp: 76.

Greene, W.H., 1999. Econometric Analysis. Prentice-Hall, New Jersey. 3rd Edition.

Hsiao, C., 2006. Panel data analysis: Advantages and challenges. University of Southern California. Wise Working Paper Series, 0602: 1-35.

IBGE, 2011. Sistema de Contas Nacionais Consolidadas. Accessed on July 12, 2012, at http://www.ibge.gov.br.

IPEA, 2012. Instituto de Pesquisa Econômica Aplicada. Accessed on July 12, 2012, at

http://www.ipea.gov.br.

Komninos, N., 2009. Intelligent cities: towards interactive global innovation environments. Int. J. Innovation and Regional Development, 1(4): 337-355.

Lenderman, D., A.M. Menéndez, G. Perry, J. Stiglitz, 2000. The cover of Mexican investment after the tequila crisis: basics economics or confidence effects? The World Bank Accessed on Sep 14, 2012, at

http://www.lacea.org/meeting2000/DanielLederman.pdf

Luporini, V., J. Alves, 2010. Private investment: an empirical analysis for Brazil. Economy and Society, 19: 449-475.

Melo, G.M., W. Rodrigues Junior, 1998. Determinantes do Investimento Privado no Brasil: 1970-1995. Texto para Discussão, 605, IPEA – Instituto de Pesquisa Econômica Aplicada. 1-33. Accessed on Jun 1, 2012, at http://www.ipea.gov.br/pub/td/td/td_605.pdf

Ferreira, J.M.G., 2005. Evolução dos Investimentos no Brasil: Uma Análise econométrica: Porque não houve recuperação das taxas de investimento no país após estabilização da inflação em 1994? In Dissertação de mestrado. FGV.EESP

Ribeiro, M.B., J.R. Teixeira, 2001. An econometric analysis of private-sector investment in Brazil. Cepal Review, 74: 153-166.

Pereira, R., 1999. Investment and uncertainty in a quadratic adjustment cost model: Evidence from Brazil. Texto para Discussão, *663*:1-9.

Rocha, C.H., J.R. Teixeira, 1996. Complementaridade versus Substituição entre Investimento Público e Privado na Economia Brasileira: 1965-1990. Revista Brasileira de Economia, 50: 378-384.

Rossiter, R., 2002. Structural cointegrationanalysis of private and public investment. International Journal of Business and Economics, 1: 59-67.

Santos, C.H., M.C.C. Pires, 2007. Reestimativas do investimento privado Brasileiro i): qual a sensibilidade do investimento privado "referência 1985" a aumentos na carga tributária? Texto para Discussão, *1297*. IPEA.

Serven, L., 1998. Macroeconomic uncertainty and private investment in LDC´s: and empirical investigation. The World Bank. Accessed on Aug 4, 2012, at http://www.worldbank.org/html/dec/Publications/Workpapers/wps2000series/wps2035/wps2035.pdf

Serven, L., 2002. Real Exchange Rate Uncertainty and Private Investment in Developing Countries. The World Bank. Accessed on Jul 7, 2012, athttp://ideas.repec.org/p/wbk/wbrwps/2823.html

Studart, G., 1992. Investimento público e formação de capital do setor privado no Brasil: Análise empírica da relação de curto e de longo prazos durante o período 1972-1989. Dissertação (Mestrado) – PUC, Rio de Janeiro.

Tadeu, H.F.B., 2010. Cenários de Longo Prazo para o Setor de Transportes e Consumo de Combustíveis. Dissertation (Doctorate) - PUC, Minas Gerais.

Tadeu, H.F.B., J.T.M. Silva, 2013a. Estimating Private Investment Functions for Brazilian Coke Production, Oil Refining, Nuclear Fuel Preparation and Alcohol Production. International Journal of Business and Commerce, 3: 26-35.

Tadeu, H.F.B., J.T.M. Silva, 2013b. Determinants of the Long Term Private Investment in Brazil: an empyrical analysis using cross-section and Monte Carlo simulation. Journal of Economics Finance and Administrative Science, 18: 11-17.

Tadeu, H.F.B., J.T.M. Silva, 2014a. Brazilian's Manufacturing Sectors: Empirical Results from Panel Data and Fixed Effects Models. WSEAS Transactions on Business and Economics, 11: 119-131.

Tadeu, H.F.B., J.T.M. Silva, 2014b. Cross-section Econometric Analyses, Monte Carlo Simulation and Scenario Planning Methodology: Brazilian Private Investments Case Study. Australian Journal of Basic and Applied Sciences, 8: 744-753.

Yigitcanlar, T., 2007. The making of urban spaces for the knowledge economy: global practices, In AlFuraih, Sahab, Hayajneh, Abdullah, Ibrahim and Thalha (Eds.) Knowledge cities: future of cities in the knowledge economy, Selangor, Malaysia, pp: 73-97.

Yigitcanlar, T., C. Martinez-Fernandez, 2007. Making space and place for knowledge production: knowledge precinct developments in Australia, State of Australian Cities Conference, 28-30 Nov 2007, University of South Australia. Adelaide, Australia.