A Look at the Evaluation Framework for Smart Growth Programmes

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Abstract: The research is focused on the methodology for the evaluation of the programmes supporting smart growth based on knowledge and innovation drivers. The paper offers a synthetic view of the smart growth concept, its evolution in the last decades and the way it is transposed into the public interventions. The pressure for a better understanding of the interventions outcomes is increasing, and the quantitative methods are expected to improve the robustness and credibility of the evidence. However, the complex environment, data availability and accessibility are some of the constraints for extensive use of quantitative methods. Tailored evaluation frameworks with clear and strong links between the programmes implemented and the evidences produced and analysed are expected to ensure evaluations are useful and lead to policies improvements.

The paper analyses the specific features of the evaluation framework of smart growth programmes with a focus on European Structural and Investment Funds 2014-2020, Smart cities strategies and their interactions.

The research methodology is based on an extensive literature review, combining principles from theory and research with practical experience, testing the models on the specific case of current ESIF programmes and adapting them to the features of the smart growth – smart cities interventions.

The paper outlines key elements of an evaluation framework, the programmes' elements and their causal links, potential evaluation questions from the perspective of smart cities stakeholders or ESIF stakeholders or both, an inventory of suitable variables with examples from the competitiveness and regional development programmes 2014-2020 in Romania.

Keywords: *impact evaluation; smart growth; smart cities; quantitative methods; competitiveness policies.*

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1. Introduction

Smart growth strategies and programmes generated high interest in the world of evaluation because the promising changes and a large amount of funding allocated and spent. The policy makers and stakeholders have high expectations from evaluators to receive credible data and sound analysis to assist them in the decision-making process and validate the policy choices.

The smart growth principles are applied in complex environments, varying in many aspects and evolving in time. This fact makes the task of the evaluators difficult, being required to adapt the methodologies to the specific conditions of the interventions. Despite the large variety of smart growth interventions, some common features allow the development of consistent methodologies to facilitate more efficient evaluations and comparability across interventions.

Various models and methods are applied to measure the effects of the public interventions in general, but the quantitative methods appear insufficiently exploited at a time when the potential to produce and use the required data is constantly increasing.

After explaining the context of the research in the introduction, the paper looks at the smart growth concept and programmes, identifying common features and differences to be considered in designing the evaluation methodologies. The next section is dedicated to the analysis of the logical construct of the smart growth programmes, aiming at building strong and logical links between the elements of the intervention. Finally, elements of an evaluation framework for smart growth programmes are analysed with a focus on evaluation questions and variables selection.

The research methodology was based on the literature review, focusing on the theory of smart growth, the practice on urban development in the last 20 years, the transition to the smart cities concept and the smart growth concept applied in the EU policies, i.e. European Structural and Investment Funds. The paper outlines the main elements of the evaluation framework of the smart growth programmes, including evaluation questions, types of variables, examples of variables suitable for competitiveness programmes and smart cities interventions, as well as their coherence.

2. The smart growth concept in the public policies.

The development policies and programmes addressed the smart growth objectives in different ways across countries, regions and cities. In all cases, there is an increasing interest to know what has been achieved with

the funding allocated, why and what makes the growth smarter and how stakeholders could make better use of the experience gained.

The literature studied for this research highlights three approaches to transpose smart growth principles in public policies: smart growth in urban planning since the early 1970s, smart cities and smart growth as a priority of Europe 2020 strategy.

Despite the smart growth principles guided policy makers in the USA already since the early 1970s, (Ingram Carbonell, Hong, & Flint, 2009), the concept gained prominence in the last 20 years in the urban planning. The primary driver of this process was the need to react to the adverse consequences of the urbanisation processes, such as air pollution, high development costs and deteriorating quality of life (Filion, 2003).

According to Downs (2005), smart growth programmes are built on six key principles and directions: (i) limiting outward extension of new development, (ii) raising residential densities in both new-growth areas and existing neighborhoods, (iii) providing for more mixed land uses and pedestrian friendly layouts to minimize the use of cars on short trips, (iv) loading the public costs of new development onto its consumers via impact fees rather than having those costs paid by the community in general, (v) emphasizing public transit to reduce the use of private vehicles, (vi) revitalizing older existing neighborhoods.

The smart growth appears as the label of the set of beliefs centred on a smarter way to accommodate economic and population growth (Befield, 2018). The concept evolved gaining more focus on quality and getting the feature of a mainstream.

A large number of models have been used to craft the strategic directions and actions for smart growth. A simple model proposed by Downs, cited by Lee and Leigh (2005) is based on four concepts on which most of the advocacy groups agree: (a) preserving significant amounts of open space and protecting the quality of the environment, (b) redeveloping inner-core areas and developing infill sites, (c) removing barriers to urban design innovation in both cities and new suburban areas, (d) creating a greater sense of community.

A new concept, smart cities, gained more and more visibility in the last decade, replacing somehow smart growth. Smart cities become a buzz word and a trend in urban development but also a vision and strategic approach. According to Boiler, cited by Harrison and Abbot Donnelly (2011), smart cities may have its origins in the smart growth concept, evolving to mean almost any form of technology-based innovation development, to make cities competitive, and attractive not only to

investments and jobs but also to talents, adapted to the needs of Y and Z generation. The modern technology and information systems are able "to make the invisible visible" providing data and analysis to city managers and a wide range of stakeholders.

Conceptual models of cities are complex systems that require complex information systems. The flow of information, adequately analysed is the foundation of continuous innovation of the interventions of various stakeholders. Harrison and Abbott Donnelly (2011) highlight the need to provide a theoretical foundation for Smart Cities intervention. One of the information models used structures the information on five layers: (i) natural environment, (ii) Infrastructure, (iii) Resources, (iv) Services, and (v) Social systems.

Smart growth appears as a strong concept in the EU policies since 2010, efficiently implemented through European Structural and Investment Funds in the 2014-2020 programming period. Thus, smart growth is one of the three mutually reinforcing priorities of Europe 2020 strategy, alongside the sustainable and the inclusive growth. The EU Smart growth priority is about developing an economy based on knowledge and innovation, strengthening knowledge and innovation as drivers of future growth. Smart growth is a multifaceted approach to development, requiring interventions in a complementary and synergic way in several sectors such as research and development, enterprise support, education, information and communication technologies, urban development and rural". Moreover, the interventions have to ensure the innovative ideas turn into new products and services that create growth, quality jobs and help address European and global societal challenges". However, to succeed, this must be combined with entrepreneurship, finance, and a focus on user needs and market opportunities" (European Commission, 2010a).

Large public funding is spent on smart growth objectives. For 2014-2020 period EUR 454 billion has been allocated by EU through the ESI

Figure 1. *Three approaches in the smart growth public policies*

Source: author's own conception

Funds to kick-start growth and job creation (European Commission, 2015). More and more cities are adopting smart strategies. Barcelona example is maybe one of the most impressing with a smart city strategy with 122 projects grouped in 22 programmes covering all areas of city management including innovation, water and waste management, lighting and others, (Bigulova, 2014).

A synthetic view of the three approaches to smart growth principles implementation in public policies is visualised in figure 1, (source: author's own conception) and detailed in table 1.

The Smart growth priority in EU policies is a wider concept than the one used in urban development and planning. The EU smart growth is broader, covering not only urban development needs, as smart growth and smart cities programmes but also rural development, knowledge and innovation being two foundation concepts for the smart growth policies and programmes. While EU smart growth priority is cascaded from the Europe 2020 strategy level to national policies, sectoral and regional development programmes, local development strategies and projects, the smart cities strategies are designed and implemented at the city level. Table 1 also reveals a significant similarity of the types of interventions in case of smart cities and EU smart growth leading to opportunities for consistent implementation, synergies and complementarities. Thus, smart cities strategies could fund their interventions from EU funds dedicated to smart growth leading to synergies with other funds, e.g. own funds of the city. Complementarities also may enhance the effectiveness of the interventions, considering the wide area of intervention of the EU smart growth programmes with a large range of programmes and projects. The intended coherence between the smart cities interventions and the EU smart growth is already stated in the strategic documents of the European Union Europe 2020, i.e. the innovation flagship initiative (European Commission, 2010b).

Table 1 Objectives and types of interventions of smart growth policies

Objectives and types of interventions		
Smart Growth Urban Development Programmes	Smart Cities Programmes	EU priority smart growth
Reducing the adverse consequences of development: air pollution, high development costs, deteriorating quality of life	Making cities more competitive and attractive, socially cohesive and environmentally sound <i>Investments in:</i>	Economic development based on knowledge and innovation in both urban and rural areas

<i>Urban planning and investments</i> aiming to: preserving open space and protecting the environment, redeveloping inner-core areas and developing infill sites, removing barriers to urban design innovation in both cities and new suburban areas, creating a greater sense of community.	all areas of city management, Research and development, Enterprise support, Education, Information and communication technologies, Urban services, Water supply and waste management, Lighting, Etc.	<i>Investments in:</i> Research and development, Enterprise support, Education, Information and communication technologies, Urban development, Rural development.
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Source: author's own conception based on Downs, cited by Lee and Leigh (2005), (Bigulova, 2014).

Thus, the ambitious objectives of Europe 2020 could be achieved only through innovation, which is to be supported by other measures through the so-called Innovation Partnerships. These development tools are expected to accelerate research, development and market deployment of innovations to tackle major societal challenges, pool expertise and resources and boost the competitiveness of EU industry, starting with the area of healthy ageing. The innovation flagship initiative indicated Smart cities strategies an area where the innovation partnership may and should work well (European Commission, 2010b). Thus, the partnerships, as representative platforms of key stakeholders of the large cities, aim to boost the use of existing and future ICT, to support the reduction of carbon emissions, increase of the share of renewable energy in the energy used for electricity supply, heating and cooling, and increase the end-use energy efficiency.

2. Building the connection between the smart growth programmes and evidence

There is an increasing belief that strong evidence of the policies' impact can help improve the effectiveness of the public policies. This belief is explicitly present in the funds' regulations and methodologies, as well as in a growing number of papers and debates in the international arena.

The evidence-based policy-making is mentioned in the definition of the "strategic policy framework" in the Common Provisions Regulations (European Commission, 2013) for the European Structural and Investments Funds (ESIF) 2014-2020: "a strategic policy framework' means a document

or a set of documents established at national or regional level, which sets out a limited number of coherent priorities established on the basis of evidence”.

The evaluation exercise is the work expected to provide ”essential and irreplaceable evidence for future policies”. Policy makers and stakeholders need to know not only what is the change in the situation addressed by specific interventions, but also what is the contribution of the intervention among other factors (Loi & Rodrigues, 2012). Moreover, they might be interested in understanding how the change was produced, what are the mechanisms leading to change, what works and what does not work.

The policy-makers’ expectations are raising the challenge for evaluators, mainly because of the need to adapt the methodologies to the specificities of the interventions aiming to support growth in general and particularly smart growth.

In some public policies’ cases, the estimation of the impacts of the programme might be more difficult than in others. For example, Bondonio (2009) explains the business incentives programmes may encounter difficulties in providing reliable and accurate estimates for the impacts of the programme. The main factors would be the reticence of the programmes’ managers in adopting methodologies based on randomised experiments and the influence of a large number of factors from the social and economic environment, acting as confounding variables. The influence of a large number of programmes implemented simultaneously should also be considered in assessing the contribution of one specific programme (Bondonio, 2009).

The essence of setting the right evaluation methodology is to have a clear and logic results chain (also referred to as causal chain) of the intervention. The results chain is not always clear in the programming phase, or other factors may arise during implementation affecting the causal links. Therefore the results chain has to be reconstructed and tested for the evaluation purposes. The results chain is expected to show the relation cause-effect between the chain elements, starting from inputs to the

Figure 2 *Causal links of an intervention*

Source: Khandker, 2010, pp 30

expected outcomes and impacts. For each element of the chain selection of the most appropriate variables appears to be essential.

The classical model for the causal chain is used extensively by the international funding organisations and European Commission (2014). The most general model links the inputs with activities, outputs, results and impacts.

The model proposed by Khandker, Koolwal, and Samad (2010), published by World Bank, as shown in figure 2, (source: Khandker (2010)), starts with the allocation of funds, and reach the desired change reflected in the outcomes and impacts, through inputs, spending and actions implemented and the corresponding outputs. While inputs and outputs are fully integrated into the intervention, the outcomes and the impacts go beyond the intervention on a long-term or in the wider social and economic environment. The ESIF model, introduced by the European Commission (2014), for the 2014-2020 programming period, refocus the causal chain on the net contribution of the intervention. The impact is the net contribution of the intervention to the expected change, the expected results. The model does not include anymore the traditional impact regarding broader effects in the social and economic environment on the longer term. The change at the results level is planned and expected at the end of the implementation of the programmes, i.e. 2023.

From this general view on the intervention logic and causal links, the analysis looks deeper into the specific features of smart growth interventions.

ESIF smart growth interventions are defined in the regulations under three thematic objectives: (i) strengthening research, technological development and innovation; (ii) enhancing access to and use and quality of ICT; (iii) Enhancing the competitiveness of SMEs, of the agricultural sector and the fishery and aquaculture sector. Other thematic objectives funded from ESIF, under the Inclusive growth strategic priority, support in a complementary manner the smart growth objectives. Two categories of interventions are most relevant to enhance competitiveness interventions: (i) Investing in education, training and vocational training for skills and lifelong learning and (ii) Promoting sustainable and quality employment and supporting labour mobility.

The interventions of the Smart cities strategies address various aspects of the city performance or city smartness. For this research, two models were selected, one describing the categories of interventions/aspects of the city smartness, and a second one regarding the categories of actors and stakeholders involved in the strategic process. Lombardi model

(2011) indicates six components, or clusters of aspects of the smartness of the cities: Smart Governance (related to participation); Smart Human Capital (related to people); Smart Environment (related to natural resources); Smart Living (related to the quality of life) and Smart Economy (related to competitiveness).

Figure 3 *Coherence of ESI Funds with Smart Cities strategies interventions*

Source: authors's own conception

The triple helix model provides a framework for Smart Cities' strategies implementation, built on the three types of actors Enterprises, Universities and the Government. They are the promoters and beneficiaries of the projects and funding available through available programmes.

The coherence of the ESIF interventions with Smart City strategies components is visualised in figure 3, for two clusters Smart Economy and Smart Human Capital. The main aspects to be retained for the design of the methodology for evaluation are described below with examples from ESI Funds 2014-2020 implementation mechanism in Romania.

Smart City interventions could be funded from ESI Funds, i.e. European Regional Development Fund. In the particular case of Romania, the interventions are funded through Competitiveness Operational Programme (COP – Priority axis 1 for RDI and Priority axis 2 for ICT investments) and Regional Operational Programme (ROP – Priority Axis 2)).

A human capital cluster of Smart cities could be funded from ESI Funds, i.e. European Social Fund. In Romania, the funding is operationalised through Human Capital Operational Programme (HCOP – Priority Axis 3 and Priority Axis 6).

Within the ESI Funds, the HCOP interventions for employability, education and training are designed in a complementary manner to COP and ROP to enhance the effectiveness of the investments in the strategic competitiveness and smart specialisation sectors and domains.

A potential constraint could be a weak capacity of the cities to implement the smart cities initiatives consistently, attracting the funds, creating synergies to achieve the planned level of smartness (Roman, 2018).

Smart economy and Smart people clusters may present a special interest for the decision makers in Romania. According to Holotescu et al. (2017) the only three Romanian cities assessed in the European ranking of medium-sized cities, published in 2007, got the lowest scores for these two clusters.

3. Evaluation Questions and Smart Variables

A set of four evaluation questions could be considered as a starting point for developing an evaluation framework for smart growth and smart cities programmes:

Q1. What is the impact of ESIF competitiveness interventions for each OP separately and all together, complementary? What are the results and how much could be attributed to ESI Funds? These questions address the ESI Funds programmes exclusively.

Q2. To what extent HCOP interventions for employment, education and training supported the smart growth objectives and enhanced effectiveness of the investments funded from ERDF.

Q3. What is the contribution of the ESI Funds to smart cities strategies' objectives? To what extent the ESI Funds have been used by municipalities for smart growth?

Q4. Which are the most effective interventions to increase the smartness of the cities? How could synergies and complementarities enhance the impact on the smartness of the cities?

The selection of the variables is an essential and challenging step to ensure a strong connection to the programmes with the evidence. Variables in the smart growth context may be labelled smart, but more importantly is to have a smart selection.

The literature offers models for the variables selection and analysis, for various types of interventions. The general one is based on the position

in the cause-effect relationship, highlighting three categories independent, dependent and confounding variables. The independent variables cause an effect on other variables but are not themselves shaped by other variables; the dependent variables are the effect of another one based on the plausible argument regarding the cause-effect relation, empirically tested. Confounding variables are referring to concomitant activities that also explain outcomes, becoming essential in the estimation of the net impact of a policy or programme. (Berman & Wang, 2011).

Looking at one of the most frequent types of interventions of the smart growth policies, the enterprise support, the evaluation model outlined by Bondonio (2009) sets three categories of variables in the causal chain of the intervention:

Type A: Variables regarding the funds available and allocated;

Type B: Variables regarding the changes in the behaviour of the firms assisted regarding investments and jobs created, maintained;

Type C: Variables regarding program-induced effects in the targeted social and economic environment.

Type A variables may be relevant for assessing the implementation process of the programmes, the variables of type B and C are dependent variables and are useful for assessing the effects of the intervention, results or impacts. When looking for an estimation of the net impacts, the net contribution of the intervention, confounding variables should be identified and analysed about the intervention planned results.

The impact of the interventions aiming to contribute to smart cities strategies should be found in the future desired state of the city, the performance of the city, presented in the literature either as: smartness of the city, value of the city (Yamauchi, Kutami, & Konishi-Nagano, 2014) or power of the city (IUS-MMF, 2017).

A model for the performance of the cities was developed by Carli, Dotoli, Pellegrino, and Ranieri (2013), structured on clusters of aspects (Economy People, Mobility, Environment, Living, Governance) and also on three types of data collection (traditional, and innovative based on data sensing and mining of Physical and Social Infrastructure).

A selection of indicators relevant for the city performance and impact of the interventions (type A of variables), but limited to the economy (enterprise and RDI) and human capital clusters of aspects, is presented in the table below.

Table 2 Cities performance indicators, relevant for the impact of smart growth public interventions.

Smartness of the city	Value of the city	Power of the city
R&D expenditure % in GDP; Employment rate in knowledge-intensive sectors; Patent applications per inhabitant; Self-employment rate; New businesses registered; Headquarters; GDP per employed person; Unemployment rate; Proportion in part-time employment.	Annual local tax revenue, Debt expenditure ratio Budget/ fiscal balance Taxable income per person Employment rate	GDP (nominal, per capita, growth rate); Level of economic freedom; World's top 500 Companies; Total employment; Wage level; Ease of securing Human Resources; Number of researchers; World's top 200 Universities; Number of researchers; RD expenditure.

Source: author's own conception based on Carli et al. (2013), Yamauchi, Kutami, & Konishi-Nagano, 2014, (IUS-MMF, 2017)

For the scope of the research we retain the list of indicators proposed by Carli et al. (2013) for the human capital (Smart people) cluster, including the following indicators: Importance as knowledge centre (top research centres, top universities, etc.); Population qualified at levels 5-6 ISCED, (Master / PhD degree); Foreign language skills; Participation in life-long-learning in %; Participation in language courses; Share of foreigners; Share of nationals born abroad; Share of people working in creative industries; Voters turnout at European elections; Knowledge about the EU; Voters turnout at city elections; Participation in voluntary work.

An indicators' framework for the evaluation of the contribution of ESI Funds to the Smart cities strategies is outlined in table 3 and table 4. The selection aimed at following the coherence of smart cities indicators with the ESI Funds indicators, either at programme level or an upper level national or EU strategic level, such as R&D expenditure % in GDP, Employment rate – age 20-64; Early leavers from education and training; Tertiary educational attainment. Further work is required to adapt the framework to the specific cities strategies to focus on the critical factors of success ensuring. Smart cities expected performance.

Table 3. Indicators framework for evaluating the contribution of ESI Funds to the smart economy and people in the cities – Impact and results level

Type of variables	ESIF competitiveness programmes indicators		SMART cities strategies
	Regional OP (Enterprise support)	Competitiveness OP indicators (RDI interventions)	
Impact (type C)	<p>For ESIF impact expected defined as the net contribution of the programme to the expected results. Impact on Smart cities strategic objectives could be measured using the following indicators: <i>Smart economy indicators.</i> R&D expenditure % in GDP; Employment rate in knowledge-intensive sectors; Patent applications per inhabitant; Self-employment rate; New businesses registered; Headquarters; GDP per employed person; <i>Smart people indicators</i> Employment rate – age 20-64; Early leavers from education and training; Tertiary educational attainment; Population qualified at levels 5-6 ISCED, (Master / PhD degree); Foreign language skills; Participation in life-long-learning in %</p>		
Results level Type C and B	<p><i>National level</i></p> <ul style="list-style-type: none"> • The survival rate of SMEs three years after set up. • Labour productivity in SMEs <p><i>Project level:</i> long-term improved business performance (at least over the durability period, three years after project completion)</p> <ul style="list-style-type: none"> • Turnover increase • Profitability rate • New jobs created/maintained 	<p>Public-private scientific co-publications at 1 million inhabitants)</p> <p>Participation of Romanian research organisations and enterprises (including in particular SMEs) in Romania to HORIZON 2020.</p> <p>Private expenditure in RDI as a percentage in BERD</p> <p>Innovative SMEs cooperating with others</p>	<p><i>Indicators at territorial level</i></p> <p>The survival rate of SMEs three years after set up.</p> <p>Labour productivity in SMEs</p> <p>Business performance indicators (to be detailed)</p> <p>Private expenditure in RDI as a percentage in BERD</p> <p>Innovative SMEs cooperating with others</p> <p>Patents</p> <p>Number of start-ups</p>

Source: *author's own conception*

Table 4. Indicators framework inputs and outputs level

Type of	ESIF competitiveness programmes indicators	SMART cities strategies
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variables	Regional OP (Enterprise support)	Competitiveness OP indicators (RDI interventions)	
Output levels Type B	Number of enterprises supported (no) Public funds allocated, spent (mil Euro) Private investments combined with public funds (mil Euro) Tangible and intangible assets Jobs created	Productive investment: Number of enterprises receiving support Number of new enterprises supported Number of new researchers working in improved research infrastructure facilities Private investment matching public support in innovation or R&D projects Number of enterprises supported to introduce new to market products Patents applications arising from projects Number of enterprises receiving financial support other than grants	Number of enterprises supported Number of new enterprises created Number of researchers working in R&D Number of enterprises supported to introduce new to market products Patents applications arising from projects Public funds spent for the smart economy and people Private investment mobilised for the smart economy and people in the cities Number of projects funded from ESIF by category of stakeholder
Input level Allocation Type A	Funds available Funds contracted	Funds available Funds contracted	ESI Funds allocated/contracted for the Smart economy and people.

Source: author's own conception

4. Conclusions

Smart growth funding and particularly smart cities strategies create a high interest of all stakeholders and the public, due to the promising changes and the massive amounts of funding allocated and spent.

Fundamentally based on knowledge and innovation drivers, extensive use of ICT in all aspects of life and work, with a high potential to collect and produce data in innovative and efficient ways, the design of evaluation frameworks should consider wider use of quantitative methods of evaluation. They are expected to ensure robust and credible evidence to

decision-makers to improve smart growth policies and programmes. The methodologies have to be adapted exploiting the full potential of an innovative environment where smart growth and smart cities investments and mechanisms are created and operationalised.

The paper offers an outline of the main elements of the evaluation framework, and sets the foundations for further research, aiming to increase evaluation robustness and credibility.

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