PLANNING COOPERATION BETWEEN CITY GOVERNMENT AND ICT FIRMS IN THE CONTEXT OF SMART CITY CONCEPT

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Abstract: In respect to planning phase of the cooperation between ICT firms and city government for Smart City concept realization there is a research gap in up-to-date studies. Most important motivation for the author in preparing the article was making the first step to fill this research gap and try to realize the article's aim by determining and putting together recommendations for cities on how to plan their cooperation with ICT firms for realization of Smart City concept. Methodology comprised: review of the Polish and foreign literature and newspaper's report and deduction on such a basis leading to formulating set of recommendations for city government. Literature review started with more general aspects of: Smart City management and cooperation management systems. Next Literature review was on: introductory elements of city government and ICT firms cooperation and ICT firms perspective on the cooperation with city government for Smart City. On the top of that examples of some cities which cooperate with ICT firms were evoked. Findings of the article are the set of eight recommendations for cities and their cooperation with ICT firms in realization of Smart City concept. The cities should prepare reports on current state in various ICT aspects and social effects. The city government should use comprehensive planning method comprising planning: activities directed on increasing the attractiveness of city for big ICT firms, special events creating ICT image of a city, involvement of local ICT firms, restructuring city office, determination of legal and organizational forms of cooperation with ICT firms, common strategic goals proposal, methods of building trust and establishment of communication rules.

The boundaries of one research article of rather preliminary character limited the scope of a study so that outside of this scope remained among others theme of the role of manufacturing firms. In the future the studies should be developed on: creation of a comprehensive model of planning the cooperation between city government and ICT firms for Smart City, next phases after planning and the role of innovative manufacturing firms in the process.

Keywords: planning in city management, smart city, cooperation models, city government, ICT firms.

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Introduction

Introductory remarks

Smart city is a concept of growing importance in contemporary management of cities. The concept is to answer the question on how to improve quality of life of city citizens using new technologies, first of all ICT technologies. From the very beginning of existence of smart city concept some of ICT companies were very interested in developing it. IBM for example played an important role in the rise of the concept (Picon, 2015). ICT companies have crucial role to play in the process of smart city implementing as they are the most important places where innovations could appear and be developed.

Identifying possible smart city solutions could be carried out in seminars with participation of ICT companies, city officials, neighbourhood communities and academia (Kramers et al., 2014). The set of stakeholders could be even broader: representatives of city government, private developers, ICT companies, NGOs, residents welfare associations, slum dwellers associations – like it was in case of workshops (20-30 participants in each event) carried out in four cities in India (Datta, 2018). In some cities associations are being established to bring together stakeholders interested in idea of smart city. In Genoa there is Genoa Association for Smart City (in Italian: Associazione Genova Smart City) in which main members are: the city of Genoa, University of Genoa, private companies, NGOs, cooperatives, associations and groupings of citizens (Girdinio, 2014).

In many cities in Poland there is a lack of smart city concept in development strategies. The similar situation had been observed in Italy. In strategic planning of capital cities of Italian regions in only four of them there is direct reference to smart city orientation. In all other strategic plans (developed in years 2006-2009) there are references to some aspects of smart city: energy efficiency, security of infrastructure, eco construction, sustainable mobility, use of ICT in production of public services (Fontana, 2014).

The aim of the article was to create a set of recommendations for cities on planning cooperation between city government and ICT companies for realization of Smart City concept. This aim had been realized and it is author's main contribution to studies on management of cooperation between city government and ICT firms for smart city. The studies of up to date literature on cooperation between city government and ICT firms for smart city are fragmentary and did not lead so far to well established theory. In up-to-date studies planning phase of the cooperation between ICT firms and city government for Smart City constitutes a research gap. Most important motivation for the author in preparing the article was making the first step to fill this research gap trying to determine and put together recommendations for cities on how to plan their cooperation with ICT firms for realization of Smart City concept.

The mentioned set of recommendations for cities had been created using methodology which comprised: review of the Polish and foreign literature and newspapers reports and deduction on such a basis leading to formulating set of

recommendations for city government. Necessary background literature review had been carried out in more general aspects of Smart City management and cooperation management systems. Literature review which was closer to the article's theme was in turn on: introductory elements of city government and ICT firms cooperation and ICT firms perspective on the cooperation with city government for Smart City. On the top of that examples of some cities which cooperate with ICT firms were evoked.

Smart City management

One of the crucial elements of smart city management is smart city planning especially on the strategic level. In respect to this function of management a number of research had been carried out with a range of different accents. One is the IoT seen as a core basis enabling smart city concept realization. It is suggested that city leaders who plan to develop strategy for smart city must have the basic understanding of IoT and their characteristics. Such smart city strategy must comprise vision, objectives and identified potential projects. Well planned investments in common technologies like sensors network and city wi-fi will help to integrate many different objectives (Reichental, 2017).

Within smart city management research is directed also on management systems in different utilities with more technological perspective:

-Smart Water management system (Shahanas & Sivakumar, 2016);

-Smart Waste management system (Nirde, Mulay, Chaskar, 2017) (Zavare et al., 2017);

-Smart Street Light Management System (Yang et al. 2020);

-Smart Traffic Management System (Sumia & Ranga 2018);

-Smart Building and Town Disaster Management System (Park et al. 2018);

-Electric Smart Grid Management (Lv, Mu, Li 2015).

Various perspectives are highlighted in respect to smart city management. One of them is "urban auditing". It concerns smart city governance which is to be rationalized on the basis of better knowledge on the given city complexity. In the perspective of urban auditing three levels are being characterized: technocratic (deeper knowledge helps better city management), emergent (socially built platforms of knowledge on cooperation between urban stakeholders) and critical (knowing to benefit urban elites) (Grossi, Meijer, Sargiacomo, 2020). Another perspective is about new challenges for human resources management in respect to smart city management. Within that a special challenge concerns smart cities managers from the corporate perspective (Ferraris, Erhardt, Bresciani, 2017). One of the directions of research on smart city management is the use of certain new precisely determined technological solutions like e.g. NB-IoT (Narrowbrand IoT) which helps in the management of the city. Within that the research could be in turn developed in various fields like e.g. environment (Brdulak, 2020). Smart city model could be of help in respect to wiser management of natural resources in city also with participation of citizens (Yitigcanlar, 2015). Within smart city management decision making process could be vastly improved by placing and integrating smart intelligent

sensors for capturing the data to be later analysed and used for better decision making (Ramamoorthy et al., 2020).

Globally in smart cities one could observe a shift from specific fields interventions to more integrated attitude with decision making based on big data. There is an emergence of Integrated City Management Platforms (ICMP). Despite the growth in computing power and enormous amount of data so far limited research is carried out on quantitative tools using this data in such a way that it would be useful for integrated smart city planning and management (Westraadt & Calitz, 2020).

Broad smart city network based on heterogeneous device environment facilitates the attack through a specific device. Therefore research is being developed in the direction of device management framework to manage each node in a comprehensive way to secure the network (Gong et al., 2019).

Cooperation management systems

Cooperation management systems stem from the cooperation in business world. First it was about cooperation within one company. Next it was developed as a concept of cooperation between companies with the strategic orientation. Often it was about medium enterprises which started to cooperate trying to survive growing market pressures caused by growing internationalization and need of innovativeness (Pampel, 2013). Cooperation between firms leads to benefits from having the relationship which help to combine the resources of these firms in a unique way (Grzesiuk, 2017).

Processes leading to opened innovative systems started with the establishment of clusters. Spatial closeness made possible cooperation between firms and made possible the knowledge transfer, trust increase and division of risk (Kidyba & Makowski, 2017).

A System of cooperation which is being developed from the 90-ties of last century is triple helix: cooperation of city government, business and academia concentrated on innovativeness. This type of cooperation system is wider in terms of kinds of actors but also in terms of the fields (it is not only about ICT). Many cities which are very advanced in terms of ICT endowments are less advanced in forming triple helix and vice versa there are cities with well built triple helix but weaker in ICT implementation (Lombardi et al., 2012).

In general cooperation system can be established when partners agree on the common strategy for gaining determined goals. In every cooperation system clear division of roles is needed. It is crucial also to agree on how the decisions of the strategic significance are to be made. The partners should try to build positive relations oriented on innovativeness in which learning competences of partners will be strengthened (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2014).

In the Capacity WORKS model the success factors of cooperation consist of the following five elements:

-strategy (clear strategy orientation);

-cooperation clearness (who are the partners and the way of cooperation between them);

-management structure (efficient management structure);
-processes (clearness about processes of strategic importance);
-learning and innovation (rules on developing learning competences) (Deutsche Gesellschaft fur Intarnationale Zusammenarbeit, 2014).

Moreover for the sake of good cooperation management one has to determine the details of ways of communication (Grossman, Lobnig, Scala, 2007). Existence and creation of cooperation network (to gain relational asset) require engagement of various actors (institutional and economic ones). Efficient experiments in smart city field in e-governance could be carried out both horizontal and vertical (Berra & Nuciari, 2013). The cooperation between city government and ICT firms in relation to smart city is of the type of horizontal cooperation.

Introductory elements of city government and ICT firms cooperation

Cooperation between city government and ICT firms for smart city could start from the report prepared by ICT firms for the city. In case of city of Lublin the experts from ICT firms suggested in such a report that the level of the ICT advancement should be equalized in every field of city activity. Second suggestion was the need of involvement of citizens in projecting and implementing new smart solutions. In the report the goal has been set to integrate all of city systems up to 2026 and then optimized them till 2030 (Sagan, 2018). This type of report could be prepared by the city itself to assess the current state of endogenous strengths, especially answering the question on how many and what type of local ICT firms already operate in the city. Especially that for every city government the endogenous development should be important. Therefore in case of projects with big foreign companies proposition of the involvement of local smaller firms could be promoted.

ICT companies both small and big ones are to provide detailed hardware and software for so called smart city operating system but the city itself must analyse how deployment of this equipment will change forms of social organization (Batty et al., 2012).

A city which would like to be a smart city could implement some introductory elements which will first make a city more attractive for the investment of ICT big companies and second they will better prepare such city for good cooperation with ICT big and small companies. Among many recommendations formulated in the research on medium-size cities in Poland most useful for the city governments in respect to smart city concept realization are the following:

-creating dedicated for firms of a given sector investment offer about the accessibility of resources of key type for these firms;
-enhancing cooperation city-business-academia;
-building data-base of offices accessible for renting in the city and their equipment;
-undertaking innovative projects which could help in creation of well-known image of the city;
-identifying and promoting non-formal initiatives and experiments;
-creating good conditions for new office buildings of high standards in cooperation with developers;

-inclusion of local IT firms into city strategic planning;
-creating creative spaces in the center of the city – co-working offices, artistic caffes etc.;
-undertaking activities for strengthening the engagement of firms which gained business success;
-supporting higher schools (Górecki et al. 2019, s. 174).
According to German entrepreneurs clear vision of Smart City realization made by city government would be of much help in the process of engaging ICT companies. This is because government is the main stakeholder to develop smart city initiatives and bring together all important other stakeholders and resources (Kraus et al., 2015). On the basis of the literature review six characteristics of relation between smart city and innovation and entrepreneurship has been developed. They are the following:

1) entrepreneurs have to play bigger role in identifying new smart city opportunities;
2) taking into account growing pollution, waste and other threats to the environment new solutions are needed;
3) entrepreneurs have to transform new ideas into new products, services and processes;
4) entrepreneurs operating in the scope of smart city should have: the possibility of using competitively priced labour forces, access to critical resources, conditions to develop new knowledge;
5) smart cities should attract new human capital with higher entrepreneurial dynamic;
6) several success stories should enhance building clusters and enhance cooperation for innovation (Kraus et al. 2015 s. 604).

ICT companies perspective of cooperation with city government for Smart City
Important issue in the theme of the article is the point of view of the ICT firms themselves. Firms prefer cities with strong technological capabilities. Some cities develop these capabilities in a conscious manner like Chicago where in IT department new unit has been launched with competences of development and design and the director of data analytics had been hired. However IBM's smarter city leader commented in this respect: "most city governments lack the capabilities and knowledge required to develop or implement pioneering technologies". Some big ICT firms which want to choose a city for cooperation rely on knowledge intermediaries like universities or consulting firms. For ICT firms an important factor is presence of project management skills in city offices (Sandulli, Ferraris, Bresciani, 2016). Managers of ICT firms underline also the importance of strong political support first of all of the mayor of the city but additionally organizational effort of the city is needed. Strong commitment of mayor could not be enough if there is resistance of the officials hired in the city office. An important aspect could also be establishment of long term flexible contract with less bureaucratic control giving the proper time for experimentation and consolidation of new technologies or public services and therefore cities and ICT firms could use more flexible legal forms

such as cooperation agreements, memorandum of understanding, research grants or short-term or cheaper contracts. Sometimes useful could be creating direct public-private bond through establishment of shared management. In cooperation between ICT firms and city government innovative culture and higher propensity to innovate also help (Sandulli, Ferraris, Bresciani, 2017).

Multinational ICT firms try to position themselves as a strategic partner for a city government and suggest that long-term and holistic vision shall be formed (Buuse & Kolk, 2019). The firms like IBM, Cisco or Accenture collecting information in various cities are trying to build standardized urban management platforms, products and services which could be customized taking into account specific needs and demands of a given city. Some researchers are critical to such positioning of big ICT firms suggesting that there should be included much broader set of societal dimensions in building smart city concept (Buuse & Kolk, 2019).

By multinational ICT companies smart city is perceived as a good business opportunity to develop certain brand for commercialization of innovative products and also useful for marketing campaigns. Matrix which had been developed by Greenbang is building a network of researchers involved with new technologies, energy, sustainability, economy etc. – it represents the attention that is paid to smart city by big multinational ICT companies like Philips, Cisco, Oracle, Samsung, IBM, Siemens, GE, Mitsubishi and ABB (De Luca, 2012).

Examples of cooperation between city governments and ICT firms

Research on Smart City planning theme should comprise also case studies. The example of carried out case study is on Bristol in UK. The analysis concerned Bristol's 2050 One City Plan focused on collaboration of partners who are to shape the city together through proper leadership, community engagement and co-production of public services (Lockwood 2020). Another case study on smart city planning was about the city of Bellevue in USA. The city planned to create a unified, data-based smart city strategy which is to integrate operations of all city departments. Special smart city team tested first water module within the city's new portal. The portal is flexible in adding next modules and new technologies (Picardal et al., 2020). Polish example of cooperation between city and ICT company is the cooperation between city of Wałbrzych and Nokia. These partners signed contract in 2018 on first of all implementation new technological solutions in city management e.g. in waste management. Nokia on the basis of contract is also to cooperate with secondary schools promoting innovative technologies and is to prepare grant program for students. The contract is one of the effects of a hackathon organized by the city with the participation of 150 young programmers who worked on applications and programs which would help to improve quality of life of city citizens. Similar initiative is being organized by Cracow from 2015 in shape of "Smogathon" on new technological antismog solutions (Property News, 2018).

The partnership of ICT big companies and city governments is even more important in case of African cities like Kigali, capital city of Rwanda. Partnering with the ICT companies which offer products and services can be a chance to gain sustainable

goals set in the city Master Plans (Burns, 2021). In case of cooperation with big ICT companies appear some warnings concerning the danger for a city being too much dependent on such a firm. Cooperation with the domination of ICT company could not have important equilibrium which is valid for cooperation good functioning (Sept, 2019).

Close cooperation between the city which is being built from scratch with ICT company could lead to using such a city as a marketing tool of the big company itself – the example is New Songdo City in South Korea located near Seoul and very close to international airport. This smart city project is supported by Korean ICT companies but also by Cisco Systems (Exner, 2014).

Set of Recommendations for City Government on Its Cooperation with ICT Firms for Smart City Concept Realization

On the basis of the above a following set of recommendations for a city government which would like to plan implementation of smart city concept in the future was formulated. The planning activities of such a city should concentrate on:

1) preparing the city's own report on the current state of ICT in various fields of city life and assessment of endogenous strengths especially in respect to number and character of local ICT firms;
2) preparing the report on the potential social effects of realization of the concept of smart city;
3) planning preliminary activities of the city to be more attractive for ICT firms especially in respect to: enhancing cooperation city-business-academia; building data-base of offices accessible for renting in the city and their equipment; creating good conditions for new office buildings of high standards in cooperation with developers; support for faculties of higher schools and secondary schools connected with ICT knowledge; setting up an event in form of hackaton or similar;
4) planning on: undertaking innovative projects which could help in creation of well-known image of the city related to ICT; creating dedicated for ICT firms investment offer comprising the accessibility of resources of key type for these firms; showing success stories of ICT firms in a city up to date;
5) involving local ICT firms to participate in the activities of the above points 3 and 4;
6) planning the process of restructuring city office so that there will be special unit for ICT design and development and data analytics, employing proper managers to manage new unit/units;
7) planning legal and organizational forms of cooperation between ICT firms and city government with the equilibrium of gains and ensuring independence of a city in the future simultaneously with clear division of roles;
8) planning common strategic goals proposal, methods of building trust and establishment of communication rules.

Limitations of Research and Suggestions for Future Research Development

Apart from role of ICT firms in smart city concept realization it is also more and more obvious that manufacturing firms should have their role in the process. Especially it is about decentralized, automated and smart manufacturing process which strengthen the role of digital technologies and smart citizens. Automated and data-driven manufacturing has its significance also from ergonometric perspective which could lead to greater job satisfaction and improved safety conditions (Suvarna et al., 2020). However exploring this theme would cross over the content of this article.

The scope of the article is diminished to cooperation between city government and ICT firms because analysing the cooperation with other actors would be too much for the content of one article. However in part of the article concentrated on cooperation there is also cooperation models background and wider perspective shown. Outside the scope of the research, although signalized in the text, were cooperation systems like triple helix and multi-actors cooperation or the theme of role of manufacturing firms in Smart Cities.

The boundaries of one research article of rather preliminary character limited the scope of a study. In the future the studies should be developed to create a model of planning the cooperation between city government and ICT firms for Smart City. Such a model could not only order knowledge and present it in an organized and clear manner but also help practicians such as mayors, city managers, city officials and ICT firms managers as well as employees in their preparations for cooperation. Moreover the future studies should be developed on the role of innovative manufacturing firms in realization of smart city concept. Various phases of cooperation of these firms with city government for smart city, starting with planning, should be another important field of the studies in the future.

After the phase of technological saturation the next phase appear which is the reflection on what is the nature and main characteristics of relation between users (clients) and the newly introduced technology (Rosiński 2020, p. 396). The article is concentrated on planning phase so next phases like implementation and control and assessment of the implementation within the theme of cooperation between ICT firms and city government shall be developed as well as studies on relations between users and new adopted technology.

Conclusions

The aim of the article which was a creation of a set of recommendations for cities on planning cooperation between city government and ICT companies for realization of Smart City concept had been realized by specifying eight recommendations. The recommendations are about preparing two reports – one of current state of ICT in various fields of a city life and the second on potential social effects of realization of the Smart City concept. Proposed planning activities are about: 1) enhancing city attractiveness for ICT big firms, 2) creation of ICT image of the city, 3) involvement

of local ICT firms, 4) modification of city office with creation of special unit for ICT design/development and data analytics and employment of proper managers to manage new unit/units, 5) determination of legal and organizational forms of cooperation between ICT firms and city government with the equilibrium of gains and ensuring independence of a city in the future, 6) clear division of roles and settlement of common strategic goals proposal, methods of building trust and establishment of communication rules.

Outside the scope of the study remained among others theme of the role manufacturing firms. In the future the studies should be developed on: creation of a comprehensive model of planning the cooperation between city government and ICT firms for Smart City, next phases after planning and the role of innovative manufacturing firms in the process.

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PLANOWANIE KOOPERACJI POMIĘDZY WŁADZAMI MIASTA A FIRMAMI ICT W KONTEKŚCIE SMART CITY

Abstrakt: W odniesieniu do fazy planowania kooperacji pomiędzy firmami ICT a władzami miasta dla realizacji koncepcji Smart City występuje luka badawcza w dotychczasowych badaniach. Najistotniejszą motywacją dla autora w przygotowaniu artykułu było uczynienie pierwszego kroku by tę lukę badawczą wypełnić i spróbować zrealizować cel artykułu poprzez określenie i zestawienie rekomendacji dla miast co do tego w jaki sposób mają planować swoją kooperację z firmami ICT w realizacji koncepcji Smart City. Metodologia objęła: przegląd polskiej i zagranicznej literatury i artykułu prasowego oraz dedukcję na tej podstawie prowadzącą do sformułowania zestawu rekomendacji dla władz miasta. Przegląd literatury rozpoczęto od bardziej ogólnych aspektów: zarządzania Smart City oraz systemów zarządzania kooperacją. Następnie przegląd literatury objął: wstępne elementy kooperacji pomiędzy władzami miasta i firmami ICT oraz perspektywę firm ICT co do kooperacji z władzami miasta w realizacji Smart City. Wnioski zostały sformułowane w postaci ośmiu rekomendacji dla miast i ich kooperacji z firmami ICT dla realizacji koncepcji Smart City. Miasta powinny przygotowywać raporty na temat bieżącego stanu w różnych aspektach ICT oraz skutków społecznych. Miasta powinny zastosować całościową metodę planowania obejmującą planowanie: aktywności skierowanych na zwiększenie atrakcyjności miasta dla dużych firm ICT, specjalnych wydarzeń tworzących wizerunek miasta ICT, zaangażowania lokalnych firm ICT, restrukturyzacji urzędu miasta, określenia prawnych i organizacyjnych ram przyszłej kooperacji z firmami ICT, propozycji wspólnych celów strategicznych, metod budowania zaufania oraz określenia zasad komunikacji.
Granice badawcze jednego artykułu o charakterze raczej wstępnym ograniczyły zakres badań stąd też poza tym zakresem pozostała m.in.: rola firm produkcyjnych. W kolejnych opracowaniach powinny być rozwinięte następujące wątki: tworzenie całościowego modelu planowania kooperacji pomiędzy władzami miasta i firmami ICT w realizacji koncepcji Smart City, kolejne fazy po planowaniu oraz rola firm produkcyjnych w całym procesie.

Keywords: Planowanie w zarządzaniu miastem, smart city, modele kooperacji, władze miasta, firmy ICT.

在智慧城市概念的背景下规划城市政府和 ICT 公司之间的合作

摘要：关于 ICT 公司与市政府合作的规划阶段，以实现智慧城市概念，最新研究存在研究空白。作者准备这篇文章的最重要动机是为填补这一研究空白迈出了第一步，并通过确定和汇总城市如何规划与 ICT 公司合作以实现智慧城市概念的建议来尝试实现文章的目标.方法包括：审查波兰和外国文献以及报纸的报道并在此基础上进行推论，从而为市政府制定一套建议。文献综述从更一般的方面开始：智慧城市管理和合作管理系统。下一篇文献综述是：市政府与 ICT 公司合作的介绍要素和 ICT 公司对智慧城市与市政府合作的看法。最重要的是，还提到了一些与 ICT 公司合作的城市的例子。本文的调查结果是针对城市及其与 ICT 公司合作以实现智慧城市概

念的八项建议。城市应准备关于 ICT **各个方面的**现状和社会影响的报告。市政府应采用综合规划方法，包括规划：旨在提高城市对大型 ICT **企业**吸引力的活动、塑造城市 ICT **形象的**专项活动、当地 ICT **企业**的参与、重组市政府、确定法律和组织形式。与 ICT **公司的合作、共同**战略目标提案、建立信任的方法和建立通信规则。

一篇相当初步的研究文章的边界限制了研究的范围，因此在这个范围之外仍然是制造企业的作用等主题。未来的研究应围绕以下**方面展开**：创建城市政府与 ICT **公司之间的智慧城市合作规划综合模型、规划后的下一阶段以及创新制造公司在此过程中的作用

关键词：城市管理规划，智慧城市，合作模式，市政府，ICT 公司。