SMART CITY 4.0 AS A SET OF SOCIAL SYNERGIES

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Abstract: Synergy is the collaborative interaction of social individuals that produces an intensified combined effect greater than that which would be the result of their separate work. Currently, the main challenge of cities as dynamically developing organizations is creating innovation and, most importantly, implementing strategies that contribute to attracting and retaining entities initiating intelligent development in the city. Cities in the smart development phase must also face the challenge of building a new quality of life by various social groups using synergies. This research shows the theory of 4T potentials, covering areas like technology, trust, talent and tolerance. The author tries to identify by the research of local politics the innovative potential of a learning city and to diagnose the innovative potential of cities in the context of entrepreneurship, innovativeness of residents, and entities that support innovativeness. This study attempts to identify results of 4T implementation in chosen cities of GZM Metropoly to identify, acquire, and develop Smart City areas and possibly synergy. The author shows the examples that the local governments of selected cities are not prepared to use the synergies resulting from the possibilities offered by Smart City.

Key words: social synergy, city management, 4T social capitals, smart city, talent management.

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Introduction

Smart City or Synergy or Innovations are very fashionable concepts nowadays. In the new reality, there is a need to create and integrate communities (including virtual ones) that bring people together around common themes. In the past, a community was understood as something permanent, stable and based on strong ties. However, the change in the model of work (and the associated disinformation) shows how many new ways of working and new tools are needed. Currently, communities are established for a certain time, and they change in the context of the goals set for them and organisations. They are based on addressing one of the most important needs of residents or employees at the moment, i.e., the need for belonging.

Temporary involvement of a team of employees or residents representing diverse perspectives of looking at challenges (resulting from the positions they occupy in the organisational structure or the level of expertise or gained experience) releases synergy. The 2+2=5 effect becomes real in the context of many tasks carried out at

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the same time. Communities organised in this way can fully draw on the potential inherent in interdisciplinary, cross-border cooperation. On the contrary, diversity releases synergy and leads to consensus. In other words, it enables the development of new quality solutions surpassing expected results.

Creativity can be defined as synergy, the interaction of different talents, developing in a conducive environment (Kaufman and Beghetto, 2013). Organisational creativity of cities must go hand in hand with effective knowledge and developing talents as a social capital that can be crucial for building a creative community. The current challenge of local governments is, first of all, to base development on the creative involvement of residents. In a smart city, referred to as the "third generation", residents begin to co-create their cities. In the case of the fourth generation, the city implements sustainable development already together with residents. It can be seen when social projects become important in urban initiatives: equality initiatives, social inclusion, cheap construction, and others. (Korneluk et al., 2019; Makieła et al., 2022). Undoubtedly, every modern city is a sophisticated ecosystem containing everything that bridges people with technology and the environment. Certainly, the distinctive feature of vigorously developing cities is the smart urban infrastructure serving residents and administration (Krzakiewicz and Cyfert, 2019). When creating Smart City 4.0, we must always consider the complex network of mutual connections that bring real benefits.

Assume that networking allows better use of synergy in the City. In that case, it can be hypothesised that only municipalities introducing networking elements can develop according to sustainable development. In the end, the author hypothesizes that the local governments of selected cities are not prepared to use the synergies resulting from the possibilities offered by Smart City.

Literature Review

The Smart City concept was created due to evolutionary research on intelligent urban environments (Caragliu et al., 2006; Katz, Bradley, 2013). The notion "smart city" means an intellectual capacity referring to the innovative, social, technical, economic aspects of development. It is distinguished by six 'smart' dimensions (Toppeta, 2014): smart economy, mobility, environment, people, life, and management. According to Kaminionos (2008, 2020), there are three phases of smart city development: Smart City 1.0, then 2.0, and 3.0. They remain open, as we observe the formation of the next phase – Smart City 4.0, inspired by economy 4.0 (Morawski, 2021).

- Smart City 1.0 refers to the earliest stage of intelligent cities formation. It involves modern technologies fostered by ICT companies, which use digital solutions, needed by the cities or not.
- Smart City 2.0 is a phase with a prevalent role of public administration. Local authorities initiate using modern technologies and introduce new solutions to improve the residents' quality of life (Azkuna, 2012; Lee et al., 2014; Zygiaris, 2013).

- Smart City 3.0 is a new approach to creating smart cities, and it can be observed since 2015. An influential modern city welcomes the engagement of itsresidents in supporting development. Local authorities' task is to create favorable conditions to maximize gain from the residents' potential. They encourage and educate citizens in using modern technologies (e.g., through projects dedicated to digitally excluded persons) and supporting them in creating technological innovations (e.g., through sharing open-source data). The phase 3.0 is part of the increasingly popular sharing economy (Han, 2019; Kinelski, 2019). It often requires the courage of municipal authorities, who must accept the growing position of citizens. However, not only the mental layer (authorities–citizens) must change, but also the communication layer.
- Smart City 4.0 – a networked city consciously striving for sustainable development. The authors of the guide for local governments in the field of Human Smart City presented how the approach to the idea of Smart City evolved regarding the activities of local government. Komninos distinguished three levels of Smart Cities development. This concept has been extended to the discussed fourth level, i.e., the concept of Smart City 4.0 – cities that take advantage of the opportunities offered by sustainable development and networking.

In the field of development, Smart City as a concept can be supported, among others, by the theory of a network society or the concept of a learning region (Komninos, 2020). Metropolises or "networked" technopoles have a colossal economic, cultural, or political advantage over other areas facing such changes (Jones, 2012). The main challenge of cities as dynamically developing organisations and networks is to implement strategies that contribute to attracting and retaining entities initiating smart growth in the city. Such entities include residents with high qualifications and civilisational competencies, enterprises and institutions creating and implementing knowledge, investors instilling new models of economic activity, and visitors who contribute to developing personal relationships between the city community and the environment (Makieła et al., 2021). Cities following the path of smart development also have to face the challenge of building a new quality of life for various social groups. It is necessary to constantly study the correlation of changes in the quality of life with the potential of 4T resources (Florida, 2012; Jourdan, 2008). Florida analysed synergistic effects in the regional development model, in which the selected indicators were for the "tolerance" component: Gay index, Bohemia index, Melting-pot index and Coolness index. For the next component, "talent", they were: population with at least a bachelor's degree (BA), super-creative core class's population, and creative professions; and for the "technology" component: Tech pole index. The author argues in his research that there is a combination of factors from the areas of tolerant community, creative professions, and a high level of technological development that dynamizes the development of cities. Metropolises with high rates of these four components, trust, tolerance, talent and technology, attract highly qualified and creative staff, people from the world of culture and art,

and investors. Thanks to such potential, such places have become the best developing cities, facing the extremely fast-changing reality.

Synergy is the positive effects of the interaction of various factors, the yield of which is greater than the sum of separate individual activities. In order to describe synergy as a phenomenon, we can use the example of the cooperation or interaction of two or more factors or forces in such a way that the combined effect of their action is greater than the simple sum of their individual achievements. In other words, regarding people, synergy is a collaborative interaction of groups that produces an intensified cumulative effect greater than that which would result from their separate work. In addition to the concept of synergy, there is also the concept of synergism, which is described in the literature (Lenartowicz, 2017). Let us assume that synergy is a term characterising the effects of action, and synergism is a theoretical approach to the phenomenon by science. Lenartowicz reports that synergism "is a new way of looking at the world and man at himself in this world"; it is a generalisation of the phenomenon of synergy, its theory and universal scientific methodology. Its subject is the laws of self-organisation of the world.

Synergy may concern the spatial form in cities. Its effect is the spatial order of cities and metropolises, an organised arrangement of components forming a harmonious whole. Secondly, synergy may concern the conduct of social dialogue in order to implement planning or investments in cities. The activation of such a "lever" requires conscious leadership. The researcher, Bieńkowski, in his scientific work (Bieńkowski, 1945), states that due to the importance of achieving the assumed goals of the institution and the strong and lasting involvement of each employee – a member of an organised community, a resident, an entrepreneur – in the implementation of these goals, leadership styles and management techniques are particularly important. Therefore, we can be conclude that the city development depends mainly on its managers but certainly not only on them.

NETWORKING as a synergy tool is currently the best means to achieve a given economic or investment goal, with particular attention to the natural environment in which we work and how we affect it. The tool to support networking is, among others, the current phase of innovativeness and inventiveness, the implementation of the Smart City concept, the fourth industrial revolution, and the "Digital Economy" (Borowiecki et al., 2021; Kinelski, 2019; Makieła, 2015). Many organisations, not only city authorities and citizens, participate in the cities' development phase. Non-profit organisations are active participants in social life and a significant part of networking society. They bring together volunteers around common values and ideals. The SMART CITY concept responds to global demographic trends, urbanisation, and striving for sustainable development (Zygiaris, 2013). As a result of demographic trends, global warming, and turmoil in the world economy, cities create space for creative social experimentation and solving the problems of the modern world (Korneluk et al., 2019). It is necessary to start by formulating challenges and defining priorities for their optimal solution in order to build so-called "Smart Cities" (Fojud, 2022; Zygiaris, 2013). This term has

many definitions in the literature, but most researchers identify it with a city with a development strategy focusing on creativity, openness to innovation, and flexibility, understood as the ability to quickly adapt to external and internal conditions (Giffinger, 2007). Smart City is an innovative concept of modernisation and networking of modern cities, the implementation of which is a challenge for urban planners, regionalists, local government authorities, and residents (Prokopowicz, 2016). Definitional disputes in the debates on Smart City concern not only formal issues in the mainstream discussion of the possibility of defining cities, conurbations or metropolises as smart but also the participation of new technologies in shaping a sustainable smart city (Angoneze-Grela, 2021). However, researchers agree that networking and the use of synergies should be sought. In order to unify the concept of Smart City, six key areas have been adopted, to which cities aspiring to be smart should refer, develop, and treat them as the main networking processes. They are shown in Figure 1.

Figure 1: Smart City networking processes
Source: Author's study based on research (Makieła et al., 2021).

For the correct formulation and understanding of the Smart City concept, it is crucial to associate it with the concept of innovation, not only technology. However, in the smart city management processes themselves, new technologies play an important role and can help municipal authorities cope with the challenges of modernity arising from the growing number of urban inhabitants and the increasing demands for digitisation (Muangmee et al., 2021; Mucha-Kuś et al., 2021; Przybyłowski, 2017).

Besides advanced technologies, the importance of soft potential is growing, including technology, talent, tolerance, and trust. The concept of Smart City is based on four 4T potentials: Tolerance, Trust, Technology, and Talent, in which advancement in the city determines its intelligence, entrepreneurship, and innovation (Stuss, 2021).

4T's advanced participation in smart city management is a determinant for the residents' quality of life and competitiveness in a bigger entity, namely metropolis. In addition to the technology that supports development, other factors are extremely important in sustainable development:

(1) Tolerance– the phenomenon of tolerance and diversity management is an extremely interesting area of management science. Tolerance allows for an uncritical understanding of man, with a full set of his traits and features that make him unique. Among these characteristics, we can distinguish, for example, age, origin, race, and sexual orientation (Mor Barak, 2014). The concept of diversity management began its development by focusing on equal opportunities for ethnic and social minorities. The next phases of development are the area of equal treatment in employment, then the areas of relations with customers, recipients of services, and social groups. An open and tolerant city will have a better chance of development and a higher level of social inclusion than a city without these features.

(2) Talent – Knowledge Management is the basis of modern organisation management. Regardless of whether we analyse the market results of the largest organisations with a global or local reach, their strategy, development directions, market offer and marketing, it can be seen that knowledge is a determinant of modern thinking. Following Morawski's research on enterprises (Morawski, 2021), it can be concluded that the "suppliers" of intellectual capital are creative residents, separated and managed by means of special programs and methods based on the concept of human capital implemented in the city as an organisation. Depending on their goals and personnel programmes, they are defined as talented artists, creative leaders, committed volunteers, and so on. The continuous, comprehensive development of innovation and creativity and the integration of key residents into the city are particularly important.

(3) Trust – the level of risk in cities and regions is rapidly increasing, especially in developing countries, where urban development is not always carried out orderly. Therefore, new technologies offer an opportunity to make cities safer. Increasingly more cities have implemented ICT-based systems to improve the security of citizens. The main system is video surveillance.

Cities prioritise their urban innovation systems from traditional urban character to innovative 'green', 'smart', and 'open', striving for environmental and social sustainability (Zygiaris, 2013).

Researcg Aim and Methodology

The mainstream of research is the analysis of local policies referring to provisions characterising 4T capitals also presented in two contexts building the desired future for the city—contents and diagnostic provisions. This study aims to analyze the use of innovative potential and the activities synergy of selected cities in a metropolis with the notions of Smart City and 4T capitals as a theoretical background. Looking for synergy corresponds with the city authorities' effort to find innovative means to achieve sustainable development, improve the citizen's access to municipal services, and increase their influence on the future of cities they inhabit. The study's main objective is to identify how the city authorities incorporate the assumptions of Smart City and 4T capital into local management focused on decarbonization. The research findings were based on interviews with residents and employees of city administration and the qualitative analysis of local policy documents.

Based on Creswell's (2013) research methodology, three research problems were formed:

- to identify the innovative potential of a learning city and to diagnose the innovative potential of cities in the context of entrepreneurship, innovativeness of residents, and entities that support innovativeness
- to identify results of synergy in GZM areas
- to identify, acquire, and develop Smart City areas

The process of research is shown in Fig. 2.

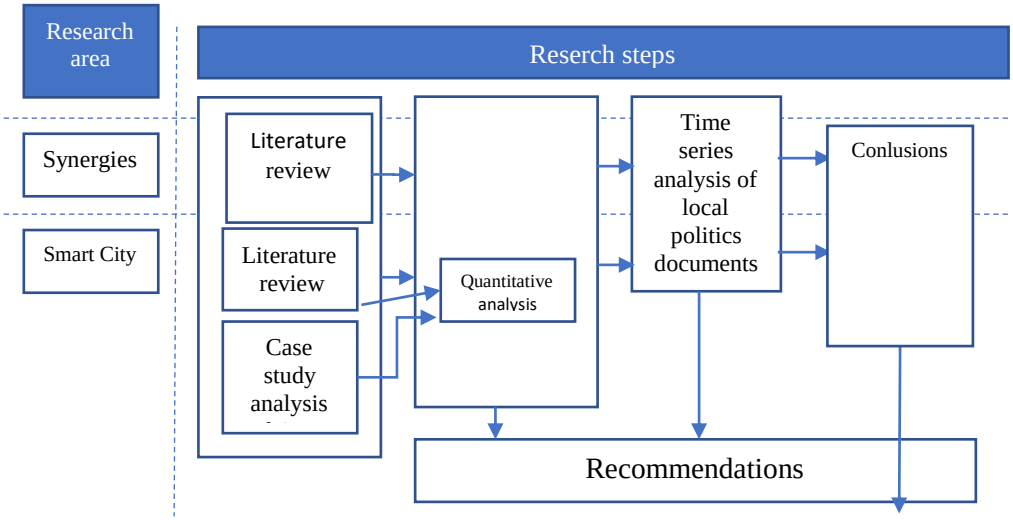

Figure 2: Research process
Source: Prepared by the author

For some researchers, using ICT technologies for city development and management is a fundamental element shaping smart cities (Toppeta, 2014). However, it should not be forgotten that the concept of 4T capitals offers greater possibilities and effectiveness than the mere use of modern technologies.
The discussed view of the city highlights the importance of pursuing a long-term development policy, especially creating strategic changes through such a policy based on participation in the decision-making processes of city users. The cities of the Metropolis GZM, which were analyzed as part of the research project, operate with an increasingly complex system of local documents: strategic, program, design and analytical. The study's main goal is to find out how the assumptions of Smart City and the 4T ideas are incorporated into city development policies and management.
The basic research method that allows to characterize and evaluate the development policies of selected GZM cities in the context of 4T capitals and the Smart City concept is the qualitative analysis of primary sources, including municipal strategic documents. Supplementary methods are interviews with local authorities and the participant observation, as the study's author actively participated in developing some of the documents in question.
The study is based mainly on the analysis of local strategic documents; particularly urban development strategies as the main sources and local/communal revitalization and cooperation programs with NGOs as secondary sources. They were selected for the study because of their complexity, long-run perspective, and fundamental role in the systems of local planning. Each document draws from the local authorities' engagement, especially the empowering values present in the 4T concept.

Research Results

The 40 local policies were examined. Answers were sought as to whether the local governments of selected cities are not prepared to use the synergies resulting from the possibilities offered by Smart City. Cities should think about the future and create politics in special local documents. The emergence of Smart City 4.0 results from the subsequent industrial revolutions, with the last dominated by the AI, nanotechnology, the IoT, and smart vehicles. All that inscribes into sustainable development that sets high standards for residents (Kinelski et al., 2021) and involves technological progress (Rutten and Gelissen, 2008; Saługa, 2021) causing vast consequences for cities and the natural environment. The idea of Smart City includes innovativeness – and several other features that make city in caring for its creative inhabitants, namely entrepreneurship, attractiveness, and competitiveness – which refers to a trend of research, which states that the greatest potential resource determining economic development is knowledge, while innovation is the main cause for economic growth and development (Bartkowiak et al., 2019; Krzakiewicz and Bartkowiak, 2021). Implementing innovations results with modernisation and increasing efficiency, competitiveness, and generated income.

In order to analyse a city development strategy that favors innovations, it is necessary to define the substance of innovation that exceeds the current framework of urban research.
Smart solutions used for implementing projects in cities and municipalities refers to respective tools, usually ICT services. It means that we move and use tools that make it possible to diagnose and reach certain things faster and better.
Local authorities can improve security through ICT systems and make their cities safer, more sustainable, and prosperous. It is important that experts from different disciplines work closely together and in cooperation with the right partners to gain the necessary experience.
The current mainstream of urban research are analyses of local policies referring to 4T capitals, typically described in two contexts—contents shaping the desired future of the city and diagnostic provisions. Such an approach allows the joint creation of a synthetic image and considering the city's planned future in the context of choosing appropriate diagnostic parts and elements (typically included in the implementation schedule, goals, and specific tasks). Their indicators are presented in Table 2.

Table 1. Direct references to the 4T capitals in the Metropolis GZM development strategies for selected cities

City	Talent	Tolerance	Technology	Trust
Mikołów	High Level	Medium Level	High Level	High Level
Siemianowice-Śląskie	Medium Level	Low Level	High Level	Low Level
Pyskowice	Medium Level	Low Level	High Level	Low Level
Dąbrowa Górnicza	Medium Level	Low Level	Medium Level	Low Level
Gliwice	Low Level	Low Level	High Level	Low Level

The presented compilation can be considered in objective and subjective categories. In the subjective approach, we could think of a ranking with the first place taken by Mikołów, Siemianowice Śląskie, and Pyskowice; the second place would take Dąbrowa Górnicza; and Gliwice would be third. The analysis was based on the cities' strategic documents. The assessment differences resulted from diverse procedures and detailed methodologies for preparing the documents as no unified guidelines were used for their creation. As a consequence, the the level of documents' length and levels of details differed as well. For instance, Mikołów's strategic document was 238-pages long as it had been thoroughly thought through and its authors' attention had been paid to the smallest details. In contrast, the documents of Siemianowice Śląskie and Gliwice were approximately 50-pages long and included only superficial conclusions instead of thorough diagnosis and analysis.

Discussions and Conclusion

The above results of the analyzed policies prove that the local governments of selected cities are not prepared to use the synergies resulting from the possibilities offered by Smart City. For example, many activities beneficial for the residents – including their convenience and satisfaction from performing public functions and providing public services making their daily functioning easier – directly impact society-building processes. Such an approach should be applied to the residents and other users of the municipality, such as stakeholders. This development should be carried out involving well-educated people who think progressively, want to develop, support employees in using their knowledge to the maximum, and provide them appropriate modern tools and flexible work hours. In a broader sense, it is a municipality that fully uses its resources and capabilities, both human and economic. Networking development is the main foundation of social development, as it balances the management process, leading to smart management, and corresponds with the functional areas of an individual and intertwining social, economic, environmental, and spatial dimensions. It is also necessary to indicate possible areas of development of research in this regard to extend the initial meaning of the ideas of Smart City and 4Ts. The analysed documents from several Polish municipalities in the Grant Smart City research project – one of the largest Polish metropolises – do not always include direct references to Smart City and 4T, or at least no clear distinctions are made between these concepts. It is possible to conduct an analysis focusing on 4T capitals understood more indirectly through factors/provisions that specify and develop them. Table 1 exploits gaps in strategic documents and synthesises the areas of Smart City impact on society (Makieła et al., 2022).

Table 2. Areas for analysis and further research when determining the impact of Smart City on social development

Talent	Technology	Tolerance	Trust
Level of education	Science and RandD – entities, networks and clusters	Quality of life in the commune for people with special needs (seniors, disabled, groups served by social welfare services) offers services, friendly spaces, etc.	Level of social integration
Work culture, work ethos, and technical culture	Intelligent solutions in city management	Openness to immigrants	Importance of cultural and natural heritage in local development
Educational offer	e-government	Openness to ethnic	Level of public

– infrastructure, entities and offer (including linking education with other fields: economy, social development)		and religious minorities	involvement in the activities of the non-governmental sector
Cultural offer – infrastructure, entities, offers and events	Digital infrastructure	Building social networks	Level of security: personal and energy security
Offer of raising competencies by various social groups	intelligent transport and network mobility	Openness to sexual minorities	Joint decision-making – public consultations
Fostering creativity	Modern and innovative industries	Combating age-based social exclusion	Trust in the authorities, continuity of governance and respect for the law

Source: Author's study based on research (Makieła et al., 2022).

In connection with that approach, it should be noted that the development of research is possible both in terms of a more detailed analysis of strategic documents and the cited revitalisation and cooperation programmes with non-governmental organisations. Public sector organisations may encounter more and more challenges when recruting, engaging, and keeping competent employees without an efficient strategy for talent management. That may limit these organisations' ability to compete with the private sector, which has learned to manage them well. The study has proven that even well-qualified HR managers, also in city management, have issues in identifying talents. Talent identification should be prioritised and actively supported by the organisation's senior management.

The main determinant of the success of the participation of residents, and thus the achievement of synergistic effects, lies in possessing the features of civil society by the society that is the recipient of the project. Participation arises during direct interaction of people who recognise a set of values as common, have confidence in each other, and are characterised by a high tolerance level. This interaction makes citizens aware of their rights and fulfilling their duties. The resident takes care of his immediate and further surroundings. He participates in its shaping and nurtures the achieved effects, in the planning of which he participated. It is how the synergy of the management, designer, contractor, and user activities is manifested.

All analysed city development strategies strongly emphasize using technology in their assumed goals. Slightly lesser attention is paid to developing human capital, i.e., talent management, while the deficit areas are tolerance and trust. Moreover,

no relationship between the coverage of 4T aspects and a given city's size, character, and potential could be observed among municipalities selected for the study. The strategies lack an elementary operationalisation of goals and references that would suggest the Smart City idea implementation in the operational and industry documents of cities.

A further direction of research in the current geopolitical situation should be security. The security level provided by cities will probably be inextricably linked to trust, but it can also go beyond this social capital.

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SMART CITY 4.0 JAKO ZBIÓR SYNERGII SPOŁECZNYCH

Streszczenie: Synergia to wspólna interakcja jednostek społecznych, która daje zintensyfikowany połączony efekt większy niż ten, który byłby wynikiem ich oddzielnej pracy. Obecnie głównym wyzwaniem miast jako dynamicznie rozwijających się organizacji jest kreowanie innowacji oraz, co najważniejsze, wdrażanie strategii, które przyczyniają się do przyciągania i zatrzymywania w mieście podmiotów inicjujących inteligentny rozwój. Miasta w fazie inteligentnego rozwoju muszą również zmierzyć się z wyzwaniem budowania nowej jakości życia przez różne grupy społeczne z wykorzystaniem synergii. Te badania przedstawiają teorię potencjałów 4T, obejmującą takie obszary jak technologia, zaufanie, talent i tolerancja. Autor stara się zidentyfikować poprzez badanie polityki lokalnej potencjał innowacyjny miasta uczącego się oraz zdiagnozować potencjał innowacyjny miast w kontekście przedsiębiorczości, innowacyjności mieszkańców oraz podmiotów wspierających innowacyjność. Niniejsze opracowanie jest próbą identyfikacji efektów wdrożenia 4T w wybranych miastach Górnośląsko-Zagłębiowskiej Metropolii w celu zidentyfikowania, pozyskania i rozwoju obszarów Smart City i ich ewentualnej synergii. Autor wskazuje przykłady braku przygotowania samorządów wybranych miast do wykorzystania synergii wynikającej z możliwości, jakie daje Smart City.

Słowa kluczowe: synergia społeczna, zarządzanie miastem, kapitały społeczne 4T, smart city, zarządzanie talentami.

智慧城市 4.0 作为一系列社会协同效应

摘要：协同作用是社会个体之间的协作互动，其产生的强化综合效应大于其单独工作的结果。目前，作为动态发展组织的城市面临的主要挑战是创造创新，最重要的是，实施有助于吸引和留住城市智能发展实体的战略。处于智慧发展阶段的城市，也必须面临不同社会群体协同打造新品质生活的挑战。这项研究展示了4T**潜力理**论，涵盖技术、信任、人才和宽容等领域。作者试图通过对地方政治的研究来识别学习型城市的创新潜力，并在企业家精神、居民创新能力和支持创新的实体的背景下诊断城市的创新潜力。本研究试图确定在 GZM Metropoly **的**选定城市中实施 4T **的**结果，以识别、获取和发展智慧城市区域以及可能的协同作用。作者举例说明，所选城市的地**方政府不准**备利用智慧城市提供的可能性所产生的协同效应

关键词：社会协同，城市管理，4T**社会**资本，智慧城市，人才管理