CULTURAL DETERMINANTS OF CITY MANAGEMENT BASED ON THE ANALYSIS OF GLOBAL CITY RANKING – THE IESE CITIES MOTION INDEX

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Purpose: This study aims to examine the relationships between the culture dimensions defined by Hofstede and the adoption of smart city solutions based on a city's position in the global smart cities ranking (the IESE Cities in Motion Index 2024).

Design/methodology/approach: Multiple regressions were used to identify the relationship between the independent variables (value of culture dimensions defined by Hofstede: power distance, individualism, masculinity, uncertainty avoidance, long-term orientation) and the dependent variable-value of the IESE Cities in Motion Index 2024. The IESE Cities in Motion Index was chosen for its temporal and thematic relevance, as it reflects the current results of several indicators that are priority indicators of the technological and social development of the city. Smart cities were selected based on their rankings in the IESE Cities in Motion Index 2024. Forty-four cities with the highest ranking (high-H and relatively high-RH) were included in the analysis.

Findings: This study has shown that higher values of long-term orientation and individualism and a low level of uncertainty avoidance have a positive impact on the adoption of smart city solutions. On the other hand, the proposed relationship between power distance and adoption of smart city solutions as well as masculinity and adoption of smart city solutions was not confirmed and requires further research. The proposed relationships between some national culture dimensions and the adoption of smart city solutions hold true for cities considered in the IESE Cities in Motion Index 2024.

Research limitations/implications: The main limitation is a relatively low number of cities taken into analysis. Another limitation is the lack of a comprehensive and complete measure that would take into account all of the various phases of the smart city management process. Regardless of these limitations, the study has achieved a part of its main research goal in proving that the proposed relationships between some national culture dimensions and the adoption of smart city solutions hold true for cities considered in the IESE Cities in Motion Index 2024. On the other hand, the study has also opened some new questions regarding the relationship between masculinity and power distance and their influence on the adoption of smart city solutions that require further research.

Originality/value: The literature does not pay much attention to the cultural determinants of smart city management in the form of organisational and managerial solutions during the transition from a classic city to a smart city; therefore, the paper tries to explore the role of cultural factors in city management and urban development. The motivation for this study is to

identify the relationship between Hofstede culture dimensions and the level of smart city solutions adaptation and their influence on a city's position in the global smart cities ranking.
Keywords: smart city, smart city management, smart city solutions, technology adoption, culture dimensions.
Category of the paper: research paper.

1. Introduction

The concept of the smart city represents a novel paradigm in urban development, emerging as a consequence of the current digital era. Driven by rapid advances in information and communications technology (ICT), smart cities offer innovative solutions to overcome various complex urban challenges.

Initially, smart cities were often identified with the use of advanced technology such as sensors, high-speed internet networks, and big data platforms (Angelidou et al., 2018). However, over time, the understanding of smart cities has developed to be more holistic and focused on improving the quality of life of society as a whole (Albino et al., 2019).

The progressive advancement of cutting-edge technologies offers novel prospects for the administration of urban development. In the contemporary era, the transformation of metropolises into smart cities represents a pivotal aspect of enhancing the quality of life for their inhabitants. The objective of the smart city concept is the implementation of contemporary urban management strategies that utilise technological instruments (Wang, Zhou, 2022).

As the cities get more digitalised, it attracts massive emigration of people from the rural areas to the urban areas in search of better living conditions and means of livelihood. Dastbaz, Naudé, and Manoochehri (2018) noted that the predicted 2050 urban surge is most likely in developing countries. Hence, managing this situation is critical. This involves planning for the infrastructure and facilities needed to cater to this emerging population; therefore, a smart city could be described as a city that uses information communication technology (ICT) to upgrade the city's functionality (Okafor et al., 2023).

A significant number of publications seek to conceptualise and define the constituent elements and application domains of smart cities, predominantly through the utilisation of case studies or comparative case study analysis. Nevertheless, it is contended that further research is required to ascertain effective strategies for urbanisation and the enhancement of urban areas.

The literature does not pay much attention to the cultural determinants of smart city management in the form of organisational and managerial solutions during the transition from a classic city to a smart city; therefore, the paper tries to explore the role of cultural factors in city management and urban development.

The motivation for this study is to identify the relationship between Hofstede culture dimensions and the level of smart city solutions adaptation and their influence on a city's position in the global smart cities ranking.

This study aims to examine the relationships between Hofstede's culture dimensions and the adoption of smart city solutions based on a city's position in the global smart cities ranking (the IESE Cities in Motion Index).

The paper is structured as follows: After this introduction, the next section presents the literature review with discussions of the research model and hypotheses development. Then research methodology is presented in detail. Finally, research findings are outlined and discussed, implications are explored, and limitations and future research are described.

2. Literature review and hypotheses development

The concept of the smart city offers many benefits to both governments and their citizens (Almuqrin, 2024), and a strategy of smart city transition has been adopted by many countries over the past couple of decades (Mutambik, 2024). Cities are becoming overcrowded with approximately 66.4% of the world's population expected to reside in cities by 2050 (Lim, Edelenbos, Gianoli, 2024). There is an urgent need for developing and applying innovative smart-city solutions and sophisticated approaches to overcome the challenges of sustainability and urbanisation (Khan, 2022).

The influence of cultural factors on new technology adoption has been recognised as a highly relevant field to be explored by many scientists (Khan, 2022; Blut et al., 2022; Venkatesh, 2022). Scientists using and validating Hofstede's national culture dimensions prove that national culture dimensions are a valid and important construct and that differences in national cultures have a large impact on many different organisational and individual behaviours and outcomes. Hofstede developed a model of five dimensions of national culture that helps to explain basic value differences. This model distinguishes cultures according to five dimensions: Power Distance, Individualism-Collectivism, Masculinity-Femininity, Uncertainty Avoidance, and Long-Term Orientation (Hofstede, 2001).

Shane (1993) was one of the first researchers to analyse the relationship between Hofstede's national culture dimensions and the adoption of new technology in different countries. He found that uncertainty avoidance has the highest impact on the adoption of new technology. Countries that scored low on power distance and high on individualism also showed higher rates of the adoption of new technology and innovation. Kaasa and Vadi (2010) found a negative relationship between power distance, uncertainty avoidance, and masculinity, while there was a positive relationship between individualism and innovation performance in a number of European countries. Woodside, Lars, and Graham (2020) highlight the impact of cultural

factors (power distance, individualism, long-term orientation) on innovative performance and consequently on the economic structure of a country. Similarly, Bukowski and Rudnicki (2019) analyse the dimensions of national culture and innovation, highlighting that the dimension of individualism alone does not fully justify the role of culture. Thus, the authors point out that long-term orientation and flexibility have a positive influence on innovation; however, this study considered only a few East Asian countries.

The first factor to be identified by Hofstede (1980) was power distance, which describes the degree of inequality between people that is still considered acceptable in a given culture. A low power distance shows relatively little inequality, where society does not accept or perceive functional human inequality in power, wealth, and prestige as inevitable (Oyserman, 2006). According to Nikolov and Krumova (2019), power distance even has a strong predictive power within the group of European countries when it comes to a very specific segment of smart cities, the e-Governance.

Power distance is the degree to which a society adheres to formal power and status differences among group members (Van Everdingen, Waarts, 2003). Individuals in low power distance cultures may be more apt to challenge assumptions, procedures, and authority figures. Hofstede (2011) suggested that lower power distance societies exhibit a greater tendency to new technology adoption and innovation.

High levels of centralisation and formalisation have been found to be associated with lower rates of innovation adoption (Rinne, Steel, Fairweather, 2012). Therefore, the first hypothesis of this study is thus as follows:

H1: *Low level of power distance positively influences the adoption of smart city solutions.*

Individualism-collectivism as a spectrum indicates a cultural preference regarding being integrated into a group, whether the people in a given country prefer activities carried out individually or those that are carried out as a member of a group. Individualistic societies prefer individuals who can manage on their own, while in collectivist societies helping each other is important; hence, the individual is supposed to show strong loyalty to the group and community. The conducted studies (Lee et al., 2007) have found that individualism has a direct positive effect on technology acceptance. Other studies (Tarhini et al., 2017) have also highlighted that individualism has not only a positive effect on readiness but also a mediating effect when it comes to other cultural dimensions. According to Masimba, Appiah, and Zuva (2019), individualism has a positive correlation with technology adoption.

Individualistic societies place a higher value on personal goals. Shane (1993) found individualistic societies to be more innovative. Other studies found individualistic cultures were more apt to adopt technologically innovative solutions. In addition, there exists a positive relationship between high individualism and innovation measures (Rinne, Steel, and Fairweather, 2012). It can therefore be expected that more individualistic societies should be more innovative (Khazanchi et al., 2007). The second hypothesis of this study is thus as follows:

H2: *Higher level of individualism positively influences the adoption of smart city solutions.*

Masculinity as a cultural dimension can be well characterised by the behaviour associated with gender roles. Masculine cultures are more achievement-orientated and exhibit less gender egalitarianism. By contrast, feminine cultures are more relationship-orientated.

What is more, in masculine societies, gender roles are more distinct than in feminine ones. Feminine cultures support the adoption of new technology more, through subjective norms and a more positive behavioural intention (Tarhini et al., 2017). In line with this, Sunny, Patrick, and Rob (2019) have also highlighted that masculine societies have a more negative attitude towards technology. Negara and Setyohadi (2020), on the other hand, emphasise that masculinity in itself might not be a good predictor of technology acceptance when it comes to smart city solutions. Contrary to this, other studies (Meyer-Waarden et al., 2021) argue that femininity has a moderating value on uncertainty avoidance and hence has a positive effect on trust towards smart solutions that increase the subjective well-being of individuals. Hofstede (2001) suggests that in organisations in masculine cultures, emphasis is on rewards and recognition of performance, and further, on training and improvement of the individual, both characteristics that are common to innovative organisations. This study proposes a positive relationship between masculinity and innovation:

H3: *Higher level of masculinity positively influences the adoption of smart city solutions.*

Uncertainty avoidance is a cultural dimension that highlights the individuals' needs for structured, regulated situations. A too-high level of uncertainty avoidance usually indicates an anxious, aspiring society, while a society with a lower value is more flexible and easy-going. Based on research data presented by Venkatesh and Zhang (2010), the implementation of new technology is likely to cause a state of uncertainty, which, in cultures with high uncertainty avoidance, causes a higher level of perceived stress and discomfort. Negara and Setyohadi (2020) have found that uncertainty avoidance is a good predictor of technology acceptance when it comes to smart city solutions. In line with this, according to other studies (Meyer-Warden et al., 2021), users from cultures with high uncertainty avoidance demonstrate higher levels of anxiety in cases of change and implementation of new technologies and have a high need for control.

Uncertainty avoidance differentiates societies on willingness to assume risk. Hofstede (2011) suggested that societies exhibiting low uncertainty avoidance are more willing to take risks and to accept opinions other than their own, both of which encourage innovation and new technology adoption. Therefore, the fourth hypothesis of this study is thus as follows:

H4: *Low level of uncertainty avoidance positively influences the adoption of smart city solutions.*

Long-term orientation is a cultural dimension that has a holistic view of time, regarding not only the past and the present but also looking into the future. In line with this, in a culture characterised by a long-term orientation, the society's time orientation is determined by long-term thinking, judging a technology or a situation both by its present and future effects rather than just seeing the immediate short-term consequences (Van Everdingen, Waarts, 2003).

Long-term orientation is closely related to frugality and perseverance, building lasting relationships, and prioritising future rewards (Chopdar, Sivakumar, 2019). On this note, according to Tran Le Na and Hien (2021), long-term orientation positively affects the functional, social, and emotional values of new technologies; hence, it is positively related to technology acceptance.

Van Everdingen and Waarts (2003) investigated the effects of national culture on the adoption of innovations and new technologies using the Hofstede dimensions. They found that higher degrees of long-term orientation were related to increased adoption of innovations and new technologies. Therefore, the fifth hypothesis of this study is thus as follows:

H5: *Higher level of long-term orientation positively influences the adoption of smart city solutions.*

Innovation management is affected by culture, and numerous studies affirm that culture influences innovation. This influence exists because culture can promote a better or worse innovative environment. Smart cities should aim to improve quality of life, as well as the efficiency and quality of services provided by governing entities and businesses (Mutambik, Almuqrin, 2024). Smart cities are emerging as a strategy to manage the problems generated by urban population growth and rapid urbanisation.

3. Materials and methods

The presented study was conducted in October 2024. Its purpose was to determine the relationship between cultural dimensions defined by Hofstede and the city's position in the global smart cities ranking (IESE Cities in Motion Index 2024).

Multiple regressions were used to identify the relationship between the independent variables (value of Hofstede's culture dimensions: power distance, individualism, masculinity, uncertainty avoidance, long-term orientation) and the dependent variable - the value of the IESE Cities in Motion Index 2024.

A statistical method for figuring out the link between two or more variables is multiple regression analysis. Multiple regression includes a dependent variable that needs to be explained as well as several explanatory factors that are assumed to cause or be connected to changes in the dependent variable.

The IESE Cities in Motion Index is a study published annually by the business school of the University of Navarra (IESE) that aims to evaluate the development of the world's cities. It assesses several socioeconomic aspects of development, including human capital, social cohesion, governance, sustainable development, mobility and transportation, urban planning, international outreach, and technology. The IESE Cities in Motion Index offers a platform for a comprehensive initial diagnosis of the cities and, through comparative analysis, aims to serve as the first point of reference. The index compares 183 cities globally, looking at 114 criteria

grouped into nine dimensions: human capital, social cohesion, economy, governance, environment, mobility and transportation, urban planning, international profile, and technology (Lai, Cole, 2023).

The IESE Cities in Motion Index (CIMI) has been designed with the aim of constructing an indicator (in terms of its completeness, characteristics, comparability, and quality, as well as the objectivity of the information it contains) that makes it possible to measure the future sustainability of the world's leading cities and the quality of life of their inhabitants. The CIMI aims to help citizens and governments understand the performance of cities in nine key dimensions. All of the indicators come together around a strategic purpose, leading to a different kind of economic and social development that entails the creation of a global city and the promotion of entrepreneurship, innovation, and social justice, among other outcomes. Developing an index with the geographic coverage and broad dimensions offered by the CIMI poses significant challenges. The results presented should be treated with caution due to a number of limitations, including data availability and comparability. In addition, the set of variables selected may not fully reflect the complexity of each dimension, and sometimes data is not available. The cities are also grouped according to their performance based on the composite indicator value. The cities are classified by performance as follows: high (H) for cities with an index value over 90; relatively high (RH) for those in the 60-90 range; medium (M) for those in the 45-60 range; and low (L) for cities with an index value below 45. In the IESE Cities in Motion Index 2024, the performance of 24.04% (44) of the cities is classified as H or RH, and the top three cities are London, New York, and Paris (in that order). The performance of 36.61% (67) of the cities is classified as M, and those classified as L account for 37.71% (69) of the selected cities. Finally, three cities (1.64%) score very low (www.iese.edu, 2024).

London tops the ranking, cementing its status as a highly developed and innovative metropolis. The city excels in key areas such as global influence, quality of human capital, government effectiveness, urban planning, and mobility systems, ranking in the top four across all of these dimensions.

New York also occupies a prominent position, ranking second overall. The city stands out for its strong economy, excellent human capital, advanced urban planning, and mobility and transportation systems, where it ranks first, second, second, and third, respectively. Despite these achievements, the metropolis faces significant challenges in terms of social cohesion and environmental sustainability.

Paris has achieved an impressive third place in the global ranking. The city demonstrates its strengths in international influence, quality of human capital, and economic performance. The French capital also stands out for its excellent urban planning and efficient mobility and transportation systems, confirming its status as an outstanding metropolis in several key areas.

Cities that excel in multiple dimensions (economic, financial, technological, cultural, and quality of life) tend to be more influential and competitive at the global level.

Smart cities were selected based on their rankings in the IESE Cities in Motion Index 2024. Forty-four cities with the highest ranking (high - H and relatively high - RH) were included in the analysis. The following cities were taken into consideration: London, New York, Paris, Tokyo, Berlin, Singapore, Oslo, Amsterdam, San Francisco, Chicago, Copenhagen, Zurich, Seoul, Munich, Boston, Hamburg, Washington, Stockholm, Melbourne, Madrid, Beijing, Vienna, Reykjavik, Basel, Rotterdam, Helsinki, Taipei, Sydney, Barcelona, Bern, Seattle, Edinburgh, Toronto, Dublin, Frankfurt, Manchester, Hong Kong, Canberra, Los Angeles, Geneva, Eindhoven, Ottawa, Dallas, Shanghai.

The category of cities with high or relatively high performance consists mostly of European and North American cities and capitals, while the low-performance category is mostly made up of African, Middle Eastern, and Latin American cities.

The IESE Index aims to help citizens and governments understand the performance of cities in nine key dimensions: human capital, social cohesion, economy, governance, environment, mobility and transportation, urban planning, international profile, and technology. All of the indicators come together around a strategic purpose, leading to a different kind of economic and social development that entails the creation of a global city and the promotion of entrepreneurship, innovation, and social justice, among other outcomes.

The IESE Index was chosen for its temporal and thematic relevance, as it reflects the current results of several indicators that are priority indicators of the technological and social development of the city.

4. Results and discussion

Multiple regressions were used to identify the relationship between the independent variables (value of Hofstede's culture dimensions) and the dependent variable - the value of the IESE Cities in Motion Index 2024 for particular cities. The results of the regression analysis have been shown in Table 1.

Table 1.
The results of regression analysis

Independent variables – national culture dimensions	Standardized coefficients Beta	t	Significance level
Low power distance	0.047	0.374	0.650
Individualism	0.472	4.231	0.000
Masculinity	0.043	0.317	0.630
Low uncertainty avoidance	0.268	3.794	0.000
Long-term orientation	0.531	4.523	0.000
Dependent variable: the IESE Cities in Motion Index 2024 $R^2 = 0.798$, F = 29,563, significance level = 0.01.			

Source: own study based on The IESE Cities in Motion Index 2024 and Hofstede's Country-Comparison-Tool (https://www.iese.edu/media/research/pdfs/ST-0649-E.pdf, 2024; https://www.hofstede-insights.com/country-comparison-tool, 2024).

The reliability test used was Cronbach's alpha. For all research variables, values were higher than 0,8. Cronbach's alpha showed high internal consistency, which implies that the measures are reliable and the evaluation instrument is appropriate for use in research.

The result shows that R-square was 0.798, which demonstrates that independent variables explain 79.8 % of the variance in the adoption of smart city solutions (the IESE Cities in Motion Index 2024). The linear relationship between Hofstede's cultural dimensions and the adoption of smart city solutions is significant with an F-value of 29.563 at the 0.01 significance level. Therefore, the model fits this study.

According to the results, power distance did not have a statistically significant relationship with the IESE Cities in Motion Index due to the significance levels (0.650) being higher than 0.05. Hence, Hypothesis 1 is rejected.

The significance level of individualism with the IESE Cities in Motion Index was 0.000, which is less than 0.05. Therefore, Hypothesis 2 is accepted. Individualism was the second highest coefficient (beta = 0.472); hence, a higher level of individualism positively influences the innovation adoption.

According to the results, masculinity did not have a statistically significant relationship with the adoption of smart city solutions due to the significance levels (0.630) being higher than 0.05. Hence, Hypothesis 3 is rejected.

The significance level of uncertainty avoidance with the IESE Cities in Motion Index was 0.000, hence, Hypothesis 4 is accepted. The beta value for this variable was 0.268. Therefore, a low level of uncertainty avoidance has a significant positive effect on the adoption of smart city solutions.

The significance level of long-term orientation with the adoption of smart city solutions was 0.000, therefore, Hypothesis 5 is accepted. The test also showed that long term-orientation had the highest coefficients (beta = 0.531) compared to other cultural dimensions. In other words, long-term orientation has the highest positive impact on the adoption of smart city solutions.

Surprisingly, power distance and masculinity were shown to be insignificant in the model. Long-term orientation, individualism, and low level of uncertainty avoidance were the three dimensions of national culture that showed significance in the model. As hypothesised, long-term orientation has shown a positive influence on the adoption of smart city solutions and the value of the IESE Cities in Motion Index. The same goes for low uncertainty avoidance and individualism, which have shown to have a positive and significant impact on the adoption of smart city solutions. Thus, hypotheses 1 and 3 of this research were rejected, while hypotheses 2, 4, and 5 are confirmed.

The results of the study are somewhat surprising. The analysis has shown that power distance does not seem to play an important role in the adoption of smart city solutions because this culture dimension was insignificant in the model.

Similarly, the masculinity dimension was insignificant in the model. Values typical for masculine and feminine cultures influence the smart city solutions in an uncertain way. For example, masculine values, such as achievement and motivation, suggest a positive relationship between the masculinity dimension and innovation adoption and new technology acceptance. On the other hand, feminine societies, where the focus is on people and cooperation, can create a more supportive climate for the adoption of innovation and new technology. Feminine cultures are characterised by values like equality, solidarity, and social relationships; therefore, they can create a more supportive climate for adopting new technologies in city management.

Regarding the relationship between long-term orientation and the adoption of smart city solutions, this study has confirmed that cities from countries with higher levels of long-term orientation have a higher value of the IESE Cities in Motion Index. National cultures with higher values of long-term orientation are more willing to embrace new ideas and solutions and are more pragmatic and problem-solving-orientated, all of the traits that can be beneficial to adopting new technology in city management. The positive hypothesised relationship between uncertainty avoidance and the IESE Cities in Motion Index has also been confirmed. Risk aversion is not the only factor that influences uncertainty avoidance, as it is expected that countries that are riskier should be more innovative and more conducive to the implementation of modern technologies in city management.

The positive relationship between a high level of individualism and the adoption of smart city solutions has also been confirmed. The more individualistic a country is, the more likely its cities will adopt innovative solutions in city management.

5. Conclusion

This study has shown that higher values of long-term orientation and individualism and a low level of uncertainty avoidance have a positive impact on the adoption of smart city solutions. On the other hand, the proposed relationship between low level of power distance and adoption of smart city solutions as well as masculinity and adoption of smart city solutions were not confirmed and require further research. This study has a number of limitations. The main limitation is a relatively low number of cities taken into analysis. Another limitation is the lack of a comprehensive and complete measure that would take into account all of the various phases of the smart city management process. Regardless of these limitations, the study has achieved a part of its main research goal in proving that the proposed relationships between some national culture dimensions and the adoption of smart city solutions hold true for cities considered in the IESE Cities in Motion Index 2024. On the other hand, the study has also opened some new questions regarding the relationship between masculinity and power distance

and their influence on the adoption of smart city solutions that require further research. One of the propositions for future research would be to enlarge the number of national cultures taken into the sample and try analysing different clusters of national cultures.

Future research should explore the impacts of other variables, which can determine the adoption of smart city solutions and city management performance. A future study should try to validate the result by using a wider sample. Finally, as smart city performance cannot be explained by culture alone, future research will analyse other elements that contribute to the development of a favourable environment for improvement of smart city management. Moreover, as this study has demonstrated that applied technological solutions already exist across the selected cities, it would be extremely useful to conduct a wider and more varied comparison involving more other cities with a view to revealing more general trends in city management.

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