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BARRIERS TO THE DEVELOPMENT OF HUMANE CITY OF NOVI SAD

Key Words

Humane city;
Novi Sad;
Barriers;
AHP;
Ranking

Abstract

The purpose of this paper is to investigate empirically and identify barriers to the development of humane city of Novi Sad. In total, 16 barriers of humane city development divided into 4 barrier categories are explored. The Analytic Hierarchy Process (AHP) method is applied to prioritize the selected barriers. The obtained results show that high cost of IT infrastructure, lack of cooperation between institutions and growing population problems are the most important barriers for humane city of Novi Sad development.

1. INTRODUCTION

Smart city development and humane city orientation are gaining considerable attention during the last two decades. The 'smart city' context includes people, mobility, economy, natural environment, and public administration that are interconnected, organized, and controlled through the Information and Communication Technologies (ICT) infrastructure [1]. The 'humane city' context includes the various concepts by which the city has been transformed according to human needs. The transformation includes, among others, the following humane aspects: new mobility services (including public transport, walking, bikes, e-bikes etc.), new perspectives for urban freight and logistics development (environmental impact assessment, congestions, noise regulations etc.) and new ICT solutions (autonomous vehicles, data collection by sensors, various ITS applications etc.). According to some researchers, smart and humane can be sometimes opposing paradigms, but optimal situation is all that is smart is also humane-oriented and vice-versa [2].

This study aims to identify the key barriers that prevent the development of overall humane aspects of the city of Novi Sad. This is also the pilot research in the field which gathers representatives of university and city's policymakers in an attempt to identify, evaluate and rank the key barriers to the development of humane city of Novi Sad. In this paper, 16 barriers of humane city development divided into four categories are explored. Authors selected Analytic Hierarchy Process (AHP) to be applied as the research method.

The rest of the paper is organized as follows. First, categories and associated barriers to humane cities development are identified in the literature and adapted to be applied in the research. Second, the proposed research methodology and data collection are explained, followed by data analysis. The paper concludes with a discussion of the key findings, implications for further research and limitations of the study.

2. BARRIERS OF HUMANE CITIY OF NOVI SAD DEVELOPMENT

Based on [3] and [4], this paper included 12 potential barriers of humane city development divided into four categories: High IT costs, Low governance, Legal and Ethical issues and Environmental issues. Additional 4 barriers are added to complement the context of this research in the city of Novi Sad. The enumerated categories and associated barriers are presented in Table 1.

Table 1. Categories and associated barriers to humane cities development

Category	Label	Barrier	Reference
High IT costs (ITC)	ITC1	High costs of IT infrastructure	Authors
	ITC2	High training costs	[4]
	ITC3	High running and maintenance costs	[4]
	ITC4	High disposal costs of used IT infrastructure	Authors
Low governance (GOV)	GOV1	Lack of cooperation between institutions	[3]
	GOV2	Lack of transparency of processes	[3]
	GOV3	Lack of trust between government and people	[3]
	GOV4	Lack of public-private partnerships	[3]
Legal and ethical issues (L&E)	L&E1	Lack of laws, policies and directions	[3]
	L&E2	Lack of standardization	[3]
	L&E3	Lack of citizens' participation in processes	[3]
	L&E4	Lack of openness of data	[3]
Environmental issues (ENV)	ENV1	Growing population problems	[3]
	ENV2	Carbon emissions effect	[3]
	ENV3	Noise effect	Authors
	ENV4	Vandalism issues	Authors

3. RESEARCH METHODOLOGY AND DATA COLLECTION

The AHP is used as the research method in this work. The AHP starts by decomposing a complex, multi-criteria problem into a hierarchy where each level consists of a few manageable elements which are then decomposed into another set of elements. Later, these criteria are mutually compared to get the priority of each criterion in hierarchy. Finally, all alternatives are compared in relation to the set of criteria. In this paper, alternatives are not defined due to the different goal of this research. However, all criteria are evaluated and ranked.

The data were collected through a questionnaire survey. First, to validate literature based barriers the experts were asked to rate the listed barriers in humane city adoption on 5-point Likert scale (1 = not at all and 5 = very significant) through a questionnaire. The barriers with rating of 2 or mean value less than 2 were excluded from the analysis. Then, the refined humane city development barriers and their categories were evaluated by the experts to quantify their significance on 9-point Saaty scale. The research model containing the barriers to humane city of Novi Sad development (at Level-1), 4 categories of barriers (at Level-2) and 16 humane city related barriers (at Level-3) is shown on Figure 1.

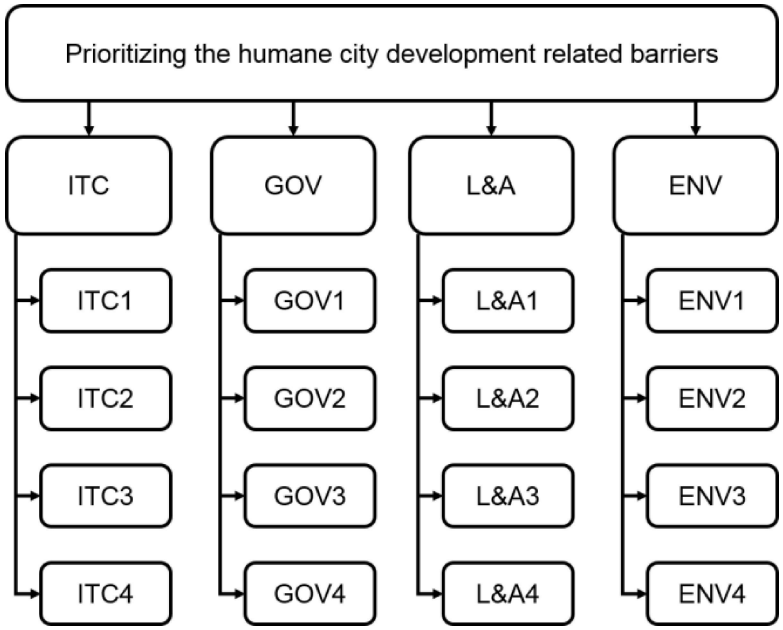

Figure 1. The research model

The data collection was performed between September 2019 and October 2019. Overall, 11 experts gave their contribution to this research. Six experts are from the Faculty of Technical Sciences in Novi Sad and five policymakers are from different institutions in Novi Sad: 3 from Provincial Secretariat for energy, construction and transport, 1 from City Council for traffic and roads and 1 from Bureau of Urbanism. The analysis is performed separately for both samples in order to highlight differences in how they perceive barriers to the development of humane city of Novi Sad.

4. DATA ANALYSIS AND RESULTS

The demographic summary of experts from the Faculty of Technical Sciences in Novi Sad and policymakers from different institutions in the city of Novi Sad is provided in Table 2. The full sampling frame was stratified by education qualification, work experience and size of organization.

Table 2. The characteristics of respondents (N=11)

		Experts from university (N=6)	Policymakers in Novi Sad (N=5)
Category	Classification	No. of experts	No. of experts
Education qualification	Master	2	5
	PhD	4	/
Work experience	< 5	/	1
	5-10	2	2
	11-15	1	/
	16-20	1	/
	> 20	2	2
Size of organization	50-250	/	1
	251-500	/	1
	1001-5000	6	3

In the first phase of analysis, the mean for all 16 factors is calculated for both groups of respondents. For one group of participants (experts from the Faculty of Technical Sciences in Novi Sad) one barrier – high disposal costs of used IT infrastructure obtained mean value less than 2, so it is excluded from further analysis for that sample. The remaining barriers have mean value greater than 2 for both samples, ranging from 2.4 to 4.33.

The preference weights and ranking for the categories of barriers for both samples is presented in Table 3. The final rank of specific barriers to humane city development for experts from the Faculty of Technical Sciences in Novi Sad and policymakers from different institutions in Novi Sad is presented in Table 4 and Table 5, respectively.

Table 3. Rank of categories of barriers to humane city development for both samples

Categories of barriers	Experts from university (N=6)		Policymakers in Novi Sad (N=5)	
	Preference weights (CR=0.0909)	Ranking	Preference weights (CR=0.0806)	Ranking
ITC	0.2592	2	0.4829	1
GOV	0.3975	1	0.2475	2
L&E	0.0996	4	0.0939	4
ENV	0.2438	3	0.1761	3

Table 4. Final rank of specific barriers to humane city development (experts from the Faculty of Technical Sciences in Novi Sad, N=6)

Category	Specific barrier	Relative preference weight	Relative ranking	Global preference weight	Global ranking
ITC (CR=0.0508)	ITC1	0.6330	1	0.1641	2
	ITC2	0.0627	3	0.0162	14
	ITC3	0.3043	2	0.0789	4
	ITC4	/	/	/	/
GOV (CR=0.0853)	GOV1	0.5403	1	0.2148	1
	GOV2	0.1825	2	0.0725	5
	GOV3	0.1754	3	0.0697	6
	GOV4	0.1018	4	0.0405	9
L&E (CR=0.0465)	L&E1	0.3852	1	0.0384	10
	L&E2	0.3641	2	0.0363	11
	L&E3	0.1636	3	0.0163	13
	L&E4	0.0871	4	0.0087	15
ENV (CR=0.0442)	ENV1	0.4520	1	0.1102	3
	ENV2	0.2349	2	0.0573	7
	ENV3	0.2166	3	0.0528	8
	ENV4	0.0966	4	0.0235	12

Table 5. Final rank of specific barriers to humane city development (policymakers from different institutions in the city of Novi Sad, N=5)

Category	Specific barrier	Relative preference weight	Relative ranking	Global preference weight	Global ranking
ITC (CR=0.0607)	ITC1	0.5101	1	0.2463	1
	ITC2	0.2366	2	0.1142	3
	ITC3	0.1817	3	0.0877	5
	ITC4	0.0716	4	0.0346	10
GOV (CR=0.0888)	GOV1	0.4654	1	0.1152	2
	GOV2	0.1515	3	0.0375	9
	GOV3	0.3160	2	0.0782	6
	GOV4	0.0672	4	0.0166	13
L&E (CR=0.0989)	L&E1	0.5769	1	0.0542	7
	L&E2	0.1807	2	0.0170	12
	L&E3	0.1161	4	0.0109	16
	L&E4	0.1263	3	0.0119	15
ENV (CR=0.0980)	ENV1	0.5231	1	0.0921	4
	ENV2	0.3003	2	0.0529	8
	ENV3	0.0782	4	0.0138	14
	ENV4	0.0984	3	0.0173	11

5. DISCUSSION

The obtained results imply that experts from the Faculty of Technical Sciences in Novi Sad and policymakers from various institutions in Novi Sad perceive barriers to the development of humane city of Novi Sad differently (Tables 3-5).

The similarities between two groups of respondents may be observed for two groups of factors: Legal and Ethical issues and Environmental issues. Experts from the Faculty of Technical Sciences in Novi Sad perceive Low governance as the strongest barrier, while policymakers from different institutions in Novi Sad perceive High IT costs as the strongest barrier. It can also be noticed that high cost of IT infrastructure, lack of cooperation between institutions and growing population problems are among the most important barriers for development of humane city of Novi Sad for both groups of respondents (Table 4 and Table 5).

Low governance is a key concern in developing an efficient humane city of Novi Sad. Within this category, barrier Lack of cooperation between institutions gains the highest priority. Therefore, there is a higher need for better cooperation between institutions in the city of Novi Sad. Long-term strategies, plans and initiatives can contribute to better cooperation between institutions in the city of Novi Sad.

High IT costs are also a strong concern in developing an efficient humane city of Novi Sad. Within this category, barrier High costs of IT infrastructure gains the highest priority. Therefore, there is a higher need for additional financial resources. Thus, policymakers in the city of Novi Sad need to provide greater investment in IT infrastructure in the future.

6. FINAL REMARKS AND LIMITATIONS

In developing countries, such as the Republic of Serbia, it is important that policymakers on different levels have good cooperation and communication with experts from universities and other institutions in order to define adequate measures, initiatives and strategies that can improve the concept of humane and/or smart city in the long run. One example of that kind of cooperation is a smart plan project for the city of Novi Sad [5]. However, this study reveals that cooperation between institutions should be improved as well as investments in IT infrastructure. These two aspects should be further explored.

The key limitations of this study are:

- A limited number of participants in the research. Although there is a limited number of surveyors, only experts from the field are included in the analysis. A further research could include more participants.
- A closed-ended questions in the questionnaire. A further research could introduce open-ended questions.
- A small number of factors in each group. A further research could be extended on larger number of factors in each group.

- Limitations of AHP method, such as a human bias and subjectivity in their judgments in forming pair-wise comparisons or consensus measure, if context is same and a group of experts has divergent priorities. A further research could be extended on some other techniques, such as Fuzzy AHP approach.

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