TI 2002-030/3
Tinbergen Institute Discussion Paper

ICT, the City and Society

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ICT, the City and Society: an analysis of perceived opportunities of urban ICT policies in Europe

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Abstract

Information and Communication Technologies (ICT) have become important tools to promote a variety of public goals. The growing importance of ICT prompts the need to consider ICT more explicitly in policies. The expected benefits from ICT encourage also urban authorities to formulate proper public ICT policies.

Against this background, various intriguing research questions arise. What are the urban policy-makers' expectations about ICT? And how do they assess the future implications of ICT for their city? An analysis of these questions will provide us with a better understanding of the extent to which urban authorities are willing to invest in and adopt a dedicated ICT policy.

This paper is focusing on the way urban decision-makers perceive the opportunities of ICT policy. First, a conceptual model is developed to explain the driving forces of urban ICT policies in European cities. Next, by highlighting the importance of understanding the decision-maker's "black box", we identify three crucial variables within this box. In the remaining of the paper we will give an operational meaning to these three variables by using a survey comprising more than 200 European cities[1]. By using statistical multivariate methods we were able to characterise the decision-makers according to the way they perceive their city (the "imaginable city"), their opinion about ICT and the way they asses the relevance of ICT policies to their city.

Key words: ICT policy, public policy-making, urban policies, factor analysis, cluster analysis

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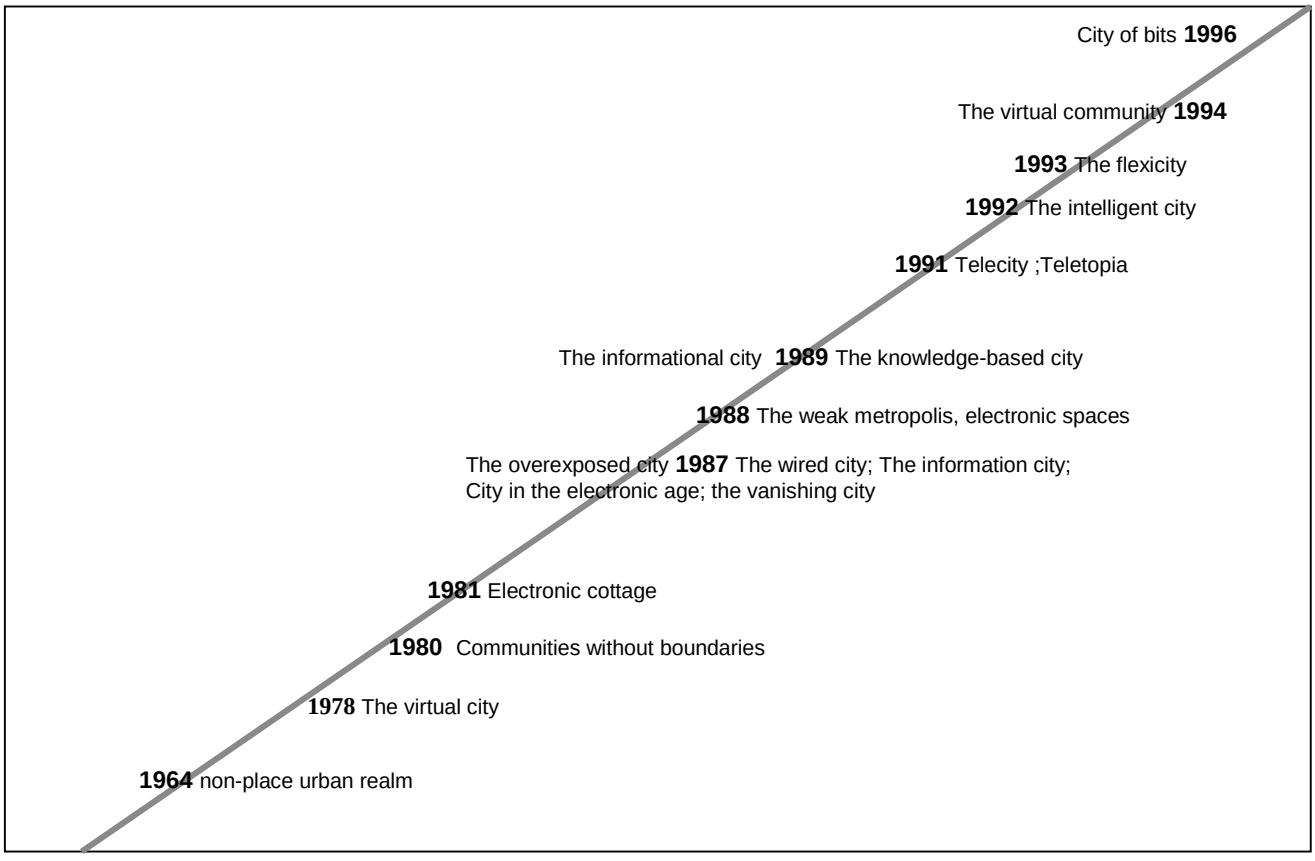
[1] The survey was part of the European research project "TeleCityVision", funded by the European Commission. The partners are: BIS (Germany), COMTEC (Ireland), CTS (Norway), ESI (The Netherlands), FHC (Spain), ICCR (Austria), THEMA (France) and ZTG (Germany)

1. Planning and policy-making for the future

1.1. Introduction

For more than twenty years already researchers and planners in many countries are making efforts to hypothesize on and to predict the effects of information and communication technologies (ICT) on the city. Ideas about the role of the city, its features or even the question whether it will survive were published in many visionary books and papers. These complex relationships led to many metaphors trying to capture the futuristic and far reaching consequences of ICT for the city and society at large. Box 1 presents metaphors that Graham and Marvin (1996) have collected to demonstrate the wide use of such images when trying to explore the unknown future. It clearly shows that the 1980's and the first half on the 1990's academic literature was dense with futuristic metaphors.

Box 1: images of the future city



Source: Graham and Marvin, 1996

Urban planners and decision-makers may agree or disagree on these varied visionary thoughts, but surely cannot ignore them when policies for the future have to be developed. Moreover, the ICT discourse is not solely taking place in the academic field. On the contrary, speculations about future urban influences of ICT are also taking place in the popular media, literature and art. Expectations and concerns on ICT expressed in many respects (economic growth, social segregation, environmental issues and so on) may motivate decision-makers to employ different policies related to ICT. Thus, the intensive ICT debate raises the question on how urban decision-

makers assess the opportunities from ICT policies and the relevance of such policies for their city.

The rising importance of ICT in everyday life, business activities and governance clearly calls for a need to incorporate it in urban policies. ICT has become part of the portfolio of competitive assets of cities. The inter-city competition is also evident through many statements and documents produced by urban governments and Non-Governmental Organisations (NGO's), which suggest that ICT can - and will be - an important policy tool to attract new economic activities at a world-wide scale (Goddard 1995; Graham 1992). However, the wide range of possible interventions tends to lead to a broad range of different ICT policies for cities (Cohen *at el*., 2002a). In general, we may distinguish two types of public ICT policies. On the one hand, dedicated infrastructure development of a generic type (supply side) is necessary to enable ICT use. On the other hand, there are policies that induce the use and adoption of ICT in both households and companies and in the public sector itself (generally, the demand side). For instance, government adoption and use of different types of ICT are important ways of supporting the development of information and telecommunication infrastructure, to stimulate new demand and to provide incentives for additional investments in the ICT sector. Other strategies for adoption may be found in education and training programs, through the facilitation of terminal equipment, for instance.

There is a clear need for more empirical and analytical insight into the drivers of urban ICT policy. This paper aims to offer a first step in trying to model empirically the critical factors that affect the urban decision-maker's assessments of ICT policy.

1.2 A model of policy-making

There are two main approaches to investigate public policy-making. The first one is normative in nature and deals with the question of how decisions should be taken. Such research is addressing the optimal way of policy-making and policy evaluation. The second type of public policy research is positive (mainly explanatory) and concentrates on the way decisions are taken in practice (see Frey 1997). In such research important questions are inter alia: how are decisions taken, how can policies be explained, which factors affect the policy-making process, and so on.

One may distinguish various analytical frameworks that may explain emerging policies according to the descriptive approach:

- *Path dependency*: previous policies determine subsequent policies, with minor alternations or adjustments. Future policies are captured in the path that was directed by prior policies. The notion of path-dependency highlights the fact that he past limits the range of choices in the present (Raadschelders, 1998). In Lindblom's words, the dominance of past and existing policy may result in a more "incremental" policy-making process (Lindblom, 1959). Thus, in order to understand current policies and to predict future policies, we need to explore previous policies. Identifying and tracing critical decision points offer anchor points to explain subsequent policies.
- *Constraints and exogenous forces*: an alternative way to understand a policy is to examine what kind of constraint a decision-maker is facing (e.g., financial budgets, national policies, and political commitments). There are many cases where policies are taken (or not taken) as a result of external commitments, national policy or opportunities to get funding. Clearly, defining what is exogenous or endogenous to the model depends on the framing of the

research. For example, in the urban context, national decisions and policies may be considered as exogenous, and thus as constraints imposed on the local decision-maker. Another example can be economic or budgetary constraints, where a decision-maker has a responsibility for a certain field, without the economic power to freely implement policies.

- *Perceptions and attitudes of individual decision-makers*: this approach explores the way public decision-makers perceive the opportunities and challenges of their city as an explanation for their attitudes, behaviour and policies. Policy response is taken as a consequence of these perceptions.

In this paper, we have chosen to focus on the third approach, namely an exploration of the way urban decision-makers perceive their city and its problems, and of the channels through which ICT may affect their city. Understanding these perceptions may explain the different ICT policies that are developed in different cities.

Dror (1986) has defined policy-making as a "*fuzzy betting attempting to influence the probability of future situations*" pointing out the uncertain nature of policies, both with regard to the future and the effectiveness of the policies that are implemented. The assessment of future situations is also based on the way decision-makers evaluate the current situation and the picture that they have in mind. Thus, both expectations on the future and the assessment of reality serve as an important input for the policy-making process. In Vickers' (1965) terminology, it is important to understand the way in which a decision-maker constructs the *reality* on the one hand (e.g., what is out there? What is the problem? What predictions can be made?) and *values* on the other hand (what values /norms are set? What ought to be? What would I like it to be). The process of reality judgement and of value judgement leads to action judgement or, in other words, to a concrete idea about the nature or direction of policies that should or could be taken (Vickers 1965; Parsons 1995). Especially in the case of ICT, which is full of metaphors and visions (as Box 1 demonstrated), it is important to include visions (values) as explanatory factor in the assessment of different policies.

Perception forms "*the portal between reality and knowledge*" (Kellman and Arterberry, 1998). Schiffman (1996) defines perception as a result of psychological processes in which meaning, relationships, context, judgements, past experience and memory play a role. In other words, perception is the result of organisation and integration of sensations into awareness of objects and environmental events.

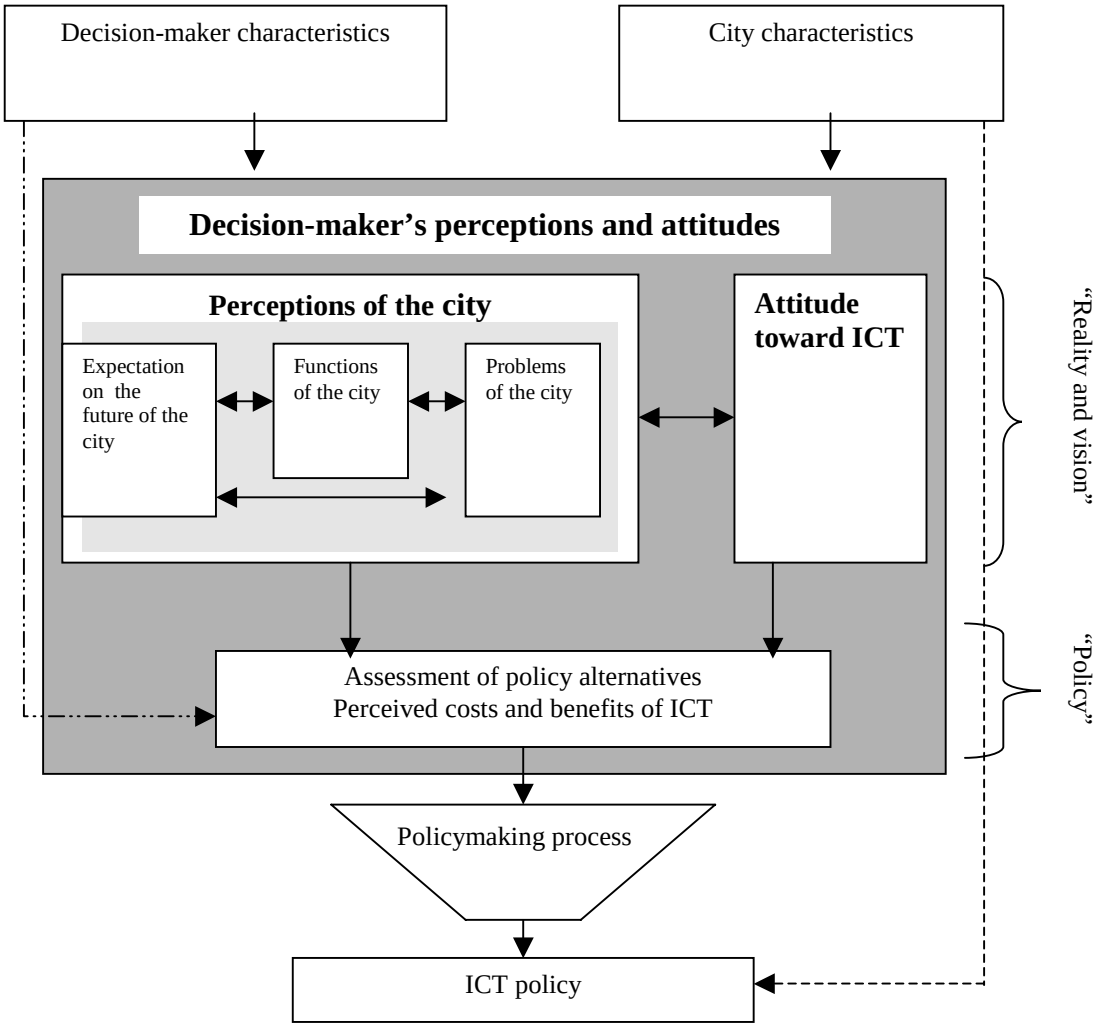
There are two main groups of perceptions that are relevant for the process of urban ICT policies. The first one is the way the decision-maker perceives his or her city, and the second one is concerned with opinions about ICT and the way it affects - and will affect – the city and the society at large. These perceptions are the input for the assessment of policy alternatives and the perceived costs and benefits of ICT policies. The next stage is, of course, the process of policy-making, in which the individual decision-maker interacts with other decision-makers, deals with constraints and commitments, and participates in the political and organisational practice.

Figure 1 presents the conceptual model of the process of policy-making. The shaded box represents the decision-maker's "black box". The perceptions and attitudes of the decision-maker have three sub-boxes that represent Vickers' dimensions. The upper two sub-boxes reflect the reality judgement and the visions of the decision-maker with regard to his or her city and ICT. The third sub-box reflects the policy judgement, the way the decision-maker assesses the policy alternatives. The perceptions and attitudes box emphasises and highlights the importance of the

personal evaluation of reality and of perceptions of the opportunities that ICT may offer.

The two upper boxes (decision-makers' characteristics and city characteristics) represent the real world. Clearly, these two factors have also a direct influence on the policy that is taken or planned (as the dashed lines are suggesting). As mentioned above, alternative approaches to policy-making research may use these lines as main explanatory variables. For example, "city characteristics" may include information about past and current policies (path-dependency approach) or economic strength (as constraints). However, those factors are also feeding the way decision-makers perceive reality.

Figure 1: Urban ICT policy-making process: the decision-maker's perspective



The analysis in this paper will focus on the decision-makers' perception box and aims to identify variables that can represent the perceptions of the decision-makers (the shaded box only). The other parts of the model will not be dealt with in the present paper for reasons of simplicity, but will be dealt with in subsequent studies.

2. The data base

2.1.Introduction to the data set

As part of the European project TeleCityVision, an extensive survey has been held targeting urban decision-makers (both politicians and responsible administrative staff) in more than 200 cities in 7 European countries (Austria, France, Germany Ireland, Norway, The Netherlands, and Spain). The survey was conducted between May and September 1999. The questionnaires were sent to various departments in the municipality that were supposed to have a direct or indirect influence on ICT related activities in the city, as well as to elected officials of the city (politicians). The effort to include various municipality department members in our sample was due to the fact that ICT policies and strategies do not have one recognised responsible body. In contrast to fields like transportation or education, where there is a clear address that is responsible for policies in the field, ICT tends to be a fragmented activity and there is no single clear address in the municipality to responsible for all relevant information. (Preliminarily analysis of the Dutch survey can be found in Cohen *et al.*, 2002b.)

As one may expect, the willingness to answer these questionnaires varied across the countries; there is an over-representation for German and Norwegian respondents (who were the most responsive respondents for the questionnaire). Approximately 1500 responses were returned, half of them from Germany. Table 1 presents the distribution of responses according to their country and the number of cities that were sampled.

Table 1: Number of respondents according to countries

Country	No. of respondents (in brackets, percentage of the sample)	No. of cities sampled
Austria	91 (5.8%)	20
France	114 (7.3%)	29
Germany	795 (51.1%)	74
Ireland	80 (5.1%)	18
The Netherlands	130 (8.3%)	27
Norway	180 (11.5%)	23
Spain	172 (11.0%)	48
Total	**1562 (100%)**	**239**

The respondents were asked to evaluate extensively a variety of attributes and aspects related to their city, the urban policies and their opinions about ICT, as well as their personal use and satisfaction concerning ICT applications. Most of the answers to these questions are given on an ordinal scale, measuring the relative degree of agreement or disagreement with different statements, or the relevance of different issues for the city. Based on these data, we will now offer an empirical operationalisation of the above conceptual model.

A first necessary step is to operationalise the variables that are assumed to represent the decision-maker's perceptions. These perceptions are essentially latent variables, built upon the responses that were received regarding relevant statements or questions on the city's ICT profile.

2.2 Perceptions of the city

In contrast to a city profile that is built upon "objective" indicators, in our research we aimed in particular at constructing a profile based on the way the

decision-makers perceive their city. In other words, we are interested in the city after it was filtered by the decision-maker's cognition. The city, as the decision-maker perceives it, is actually the city that he or she is making decisions on, and hence it is for him or her the relevant city to be explored in empirical policy research.

There are many possible candidate variables for making up the city profile. We have chosen a taxonomy based on three main profile elements of the city:

- Problems of the city
- Main functions of the city
- Expectations on future development of the city.

Based on opinions and perceptions of these three urban profile elements, we aim in the sequel of this paper at creating the so-called "imaginable city", the city seen through the eyes of the decision-maker, which forms the action ground for ICT policy.

2.3 Opinions about urban ICT

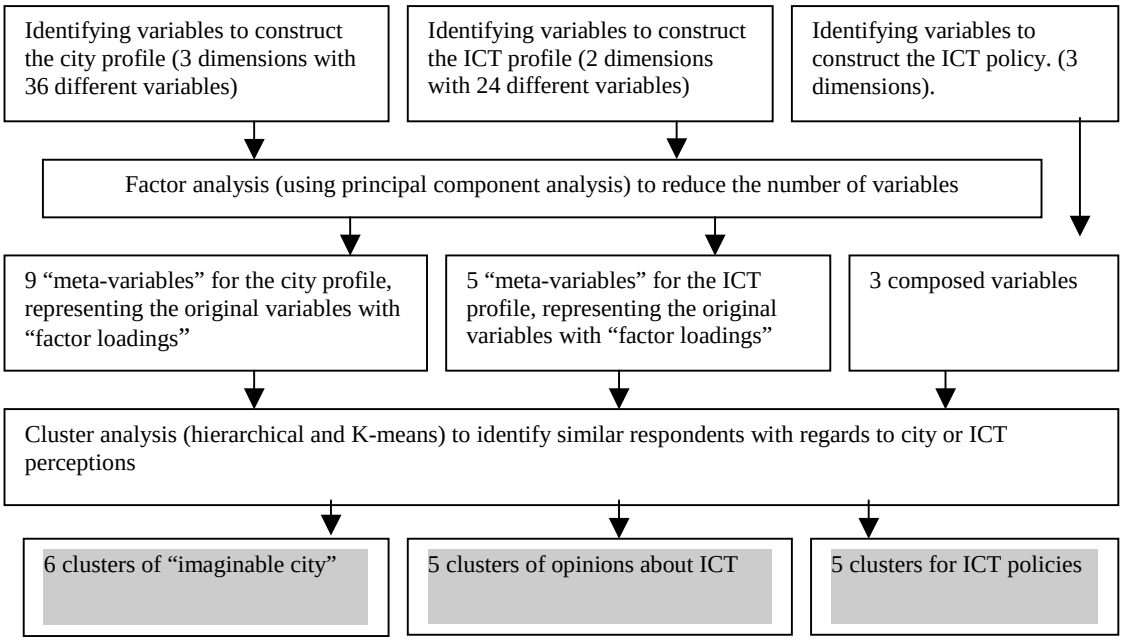
Decisions are the response to personal views, images and perceptions of reality. This calls for a careful analysis. Can we identify classes of attitudes towards or opinions about ICT? The second part of the perception box in Figure 1 contains different types of opinions about ICT. Here, we will try to recognise patterns of opinions about ICT by using a list of statements regarding ICT relationships with the urban administration, the city and society at large.

2.4. ICT policy profiles

The third variable that needs to be constructed is the dependent variable, i.e., the assessment of the relevance of ICT policies as perceived by the decision-maker. Like in the previous cases, this variable contains various dimensions:

- The perceived goals of ICT policies;
- The perceived relevant tools to employ ICT policies;
- The perceived role of the municipality with regard to ICT activities in the city.

Figure 2: Creating profiles of cities and ICT opinions



These three groups of variables (city profile, ICT profile and ICT policies profile) form the building blocks of the box that represents the decision-maker's perception and the box related to the assessment of ICT policies. The rest of the paper is now focusing on these three latent variables and the types of perceptions that could be found in our empirical research.

Figure 2 describes the methodology that has been used in this paper to create the profiles for the city and opinions about ICT.

In a large sample like ours with many different cities, traditions and ICT clusters, there is always a chance that some questions may be difficult to answer. In Annex A we have indicated how to deal with don't know answers.

3. The imaginable city

As mentioned above, the city is not a given spatial unit, but a social construct. In our approach we take for granted that the imaginable city is built upon three main elements of the city: main functions, problems and expectations on the future. The first dimension, main functions of the city, is based on a series of urban functions that the respondents were asked to evaluate, in particular the extent to which these are relevant for their city (very relevant, moderately relevant, little relevant, not at all relevant, and no opinion). The urban functions that were distinguished in the questionnaire are listed in Box 2.

Box 2: main functions of the city

An industrial centre
A services centre
An administrative centre
A centre of logistics
A centre for tourists
A commercial centre
An ICT and/or multimedia centre
A centre for higher education
An important city in the regional context
An important city in the national context
An important city in the European urban system

The second dimension of the city profile is the extent to which different urban problems are relevant to the profile of the city, as the respondent perceives it (very much, to some extent, a little, not at all, and no opinion). Box 3 presents the urban problems that were listed in the questionnaire.

Box 3: urban problems

Traffic congestion
Housing shortage
Lack of land reserve
Unemployment
Decline in the industrial sector
Ageing population
Sub-urbanisation/ urban sprawl
Decline of the city centre
Socio-spatial segregation
Problematic real estate market
Lack of open (green) space
Negative image of the city
Pollution
Budget deficit
Problems in the education system

The third dimension of the city profile is the expectation and assessment of future trends of the city. The respondents were asked to express their expectations on the nature and direction of various urban trends in ten years from now (considerable increase, modest increase, no change, decrease, and don't know). Box 4 contains the trends that were included in the questionnaire used in our empirical work.

Box 4: trends for ten years from now

The importance of our city
Competition between our and other cities
Co-operation between our and other cities
The potential of our city to attract service companies
The potential of our city to attract industrial enterprises
The potential of our city to attract new residents
In general, the importance of the CBD in our city
Suburbanization
Socio-spatial segregation in our city
Traffic in our city
The effectiveness of environmental protection in our city

Based on the evaluation of these 3 predominant dimensions, the imaginable city can be virtually created. However, since there are many variables, a multivariate analysis is needed to identify some underlying structural patterns. Therefore, a factor analysis was performed to examine whether we can identify fundamental underlying variables that represent the above complex urban mapping. In this analysis, each individual variable gets a 'factor loading', viz. the correlation between the original variable and the factors that were calculated (in the factor analysis). In other words, (squared) factor loadings indicate what percentage of the variance in the original variable is explained by the factor concerned. Thus, for each variable, the factor with the highest value is assumed to represent best the variable itself. Grouping the variables according to their factor loadings is supposed to create new meta-variables (the factors themselves) that are best representing all relevant variables in the group. If the variables that were grouped together can be meaningfully interpreted (i.e., a suitable taxonomy and contents can be found for the group of the variables), we can tentatively accept the analysis results. Table 2 presents the group of variables that were obtained by the factor analysis as well as the results and the interpretation suggested for each group. The nine factors explain 57% of the 37 variables. Indeed, the results suggest that the goodness of model is acceptable, but not good. Table B1 in the Appendix B shows the extraction and components of the nine factors. Notice that there are only a few variables that belong to more than one factor group. It means that those variables are represented significantly in more than one factor and thus affect to a large extent the scores of the respondents on these factors.

When performing factor the analysis, each observation gets a 'factor score', a composite measure for each observation on each factor extracted from the factor analysis. The factor weights are used in conjunction with the original variable values to calculate each observation's score. These scores can be used to represent the factors in a subsequent analysis. The next step in our analysis is to examine whether we can identify groups of respondents according to their perception of the city. In other words, after clustering variables by means of factor analysis methods and creating a reduced number of variables that are representing the city, we will investigate whether

we can cluster observations according to these variables and identify clusters of imaginable cities.

Table 2: Factor-variables for city profiles based on factor analysis *

Title of the factor-variable	Variables that are included in the factor-variable
Factor 1: socio-economic problems	Unemployment Industrial decline Aging population Suburbanization (problem) Decline of CBD Social segregation Negative image Budget deficit Education problems
Factor 2: regional functions	Service center Administrative center Commercial center ICT center Education center Regional importance (A logistic center)
Factor 3: attractiveness trends	The importance of the city Potential to attract service companies Importance of CBD (Potential to attract industrial companies)
Factor 4: spatial problems	Traffic congestion Housing shortage Lack of land reserves Problematic real estate market Lack of green areas (Pollution)
Factor 5: suburbanization and segregation trends	Trend: Social segregation Trend: Suburbanization (problem: Suburbanizatio)
Factor 6: industrial functions	Industrial center Logistic center Pollution problem
Factor 7: national functions	Tourist center National importance European importance (negatively: trend, traffic flows)
Factor 8: positive trends	Co-operation among cities Effectiveness of environmental protection Potential to attract industrial companies
Factor 9: competition trends	Competition among cities (negatively: traffic problems)

*(In parentheses variables that mainly belong to an other group, but are also affecting significantly the current group)

We have used cluster analysis in two stages. The first step was a hierarchical cluster analysis, where clusters were determined in a hierarchical process. It starts with N-1 clusters (N= sample size) and in each step it decreases the number of clusters according to specific criteria (average linkage between groups, clustering according to the average similarity for links between two centres; see Anderberg, 1973). The process ends with just one cluster. Naturally, reducing the number of clusters reduces also their homogeneity; thus, the optimal number of clusters is the

lowest number of clusters that has an acceptable level of heterogeneity. The second step uses the clusters that were found in the first step as initial centre points for the k-means cluster analysis. Here, the number of clusters is determined a priori, where in an iterative way observations are clusters around centroids that are adjusted in each iteration. Since the initial centroids are affecting the clustering process (clustering the same data with different initial centres would produce different clusters), we have used the mean values of each cluster that was created in step 1 as the initial centroid for the second clustering process. Based on these two clustering processes 6 clusters were created, representing six different perceptions of the city.

The final cluster centroids (the mean values across the cluster for each "factor" variable) are presented in Table 3. Moreover, in order to check how homogeneous the clusters are with regard to each factor variable, with used a graphic representation (a graph of the cases in each cluster to observe the heterogeneity of the cluster). Thus, we determined whether the cluster is homogeneous, tends to have a unified pattern or to have no pattern at all (indicated in Table 3 as well). According to the average score in each cluster, we can characterize the average choices of the respondents in those clusters. These scores can then be translated back to the ordinal scale (bearing in mind that the scores are just an approximation, and that the verbal representation is used in order to distinguish between different clusters). Since in our questionnaire "very much" answers got the value "1" and "not at all" got the value "4', where high values indicate less relevance and low values indicate a high relevance. Thus, negative values of the factor scores represent the answers "very much " and "to some extent", and positive values represent the answers "a little " and "not at all". Table 3 includes the verbal meaning of the average factor scores.

Based on the above results, we will now offer a taxonomic interpretation of various city classes, as they can be extracted from the 6 clusters in Table 3. The classes distinguished are to be seen as prototype cities.

Optimistic industrial city. In cluster 1 we find respondents that tend to see their city as having mainly industrial functions. They think that socio-economic problems are not relevant to their city and that spatial problems have just a low relevance. They believe that the city will increase its attractiveness to residents and services companies and its importance of its CBD, as well as will improve in other positive respects. They also tend to anticipate increase in competition with other cities.

*Multi-functional optimistic city***.** In cluster 2 there are respondents that tend to see their city as having a multiplicity of functions: national and regional, and to some degree also industrial functions. There are just little socio-economic problems and no spatial problems at all. Also here, the expectations for the future are quite optimistic. Both attractiveness trends and positive trends are likely to increase, while less positive trends are likely to remain the same (suburbanization, segregation and competition).

Struggling national-industrial centre. The third cluster contains respondents who perceive their city as having an important role as a national centre as well as an industrial one. To a lower degree, it has some regional functions. Their cities suffer, to some extent, from both socio-economic problems and spatial problems. In this cluster, the respondents do not consisted in their opinions about all future trends, but they do agree that positive trends are likely to remain the same, and competition among cities is likely to increase to some extent.

Crowded-developed regional center. In the forth cluster we can find respondents that perceive their city mainly as having regional functions. In addition, there is tendency among them to think that the city has some industrial and national

functions. The city is suffering from severe spatial problems, not necessarily from socio-economic problems. They are expecting suburbanization and segregation to increase considerably, and they believe that the ability of their city to attract firms and residents will increase considerably while the competition with other cities will remain the same.

Table 3: 6 clusters of imaginable cities

Factor	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Socio-economic problems	1.178 Homogeneous Not at all	.7637 Homogeneous A little	-.5258 Homogeneous To some extent	-.0279 No pattern	-.3089 Tendency To some extent	-.8264 Homogeneous Very much
Regional functions	-.0176 No pattern	-.3144 Tendency To some extent	-.4289 Tendency To some extent	-.6103 Homogeneous Very much	.0015 No pattern	1.367 Homogeneous Not at all
Attractiveness trends	-.4582 Tendency Increase to some extent	-.5147 Tendency Increase-increase to some extent	.2022 No pattern	-.8407 Homogeneous Increase considerably	.497 Tendency Same	.8324 Homogeneous Same-decrease
Spatial problems	.4157 Tendency A little	.6725 Tendency Not at all	-.3822 Tendency To some extent	-.8824 Homogeneous Very much	-.0063 No pattern	.112 No pattern
Suburbanization and segregation trends	.657 Homogeneous Same	.4919 Tendency Same	-.1068 No pattern	-1.2415 Increase considerably	-.1848 No pattern	.3227 Tendency Decrease
Industrial functions	-.3209 Tendency To some extent	.3891 Tendency A little	-.5834 Tendency Very much	-.5444 Tendency To some extent	1.0494 Homogeneous Not at all	-.3021 Tendency To some extent
National functions	.1179 No pattern	-.3748 Tendency To some extent	-.7969 Homogeneous Very much	-.3212 Tendency To some extent	.386 Tendency A little	1.0167 Homogeneous Not at all
Positive trends	.8605 Homogeneous Increase/ increase to some extent	-1.042 Homogeneous Increase considerably	.6614 Homogeneous Same	-.2071 No pattern	-.2947 No pattern	.2053 No pattern
Competition trends	-.599 Tendency Increase to some extent	.2745 Tendency Same	-.6754 Homogeneous Increase to some extent	.4752 Tendency Same	.7312 Homogeneous Decrease	-.3301 Tendency Increase to some extent
Respondents in cluster	**191**	**248**	**258**	**195**	**276**	**228**

Stable semi-national city. The fifth cluster contains respondents who think that their city has no industrial functions at all and limited national functions. These cities have, to some extent, socio-economic problems. Competition with other cities is expected to decrease, while the ability to attract companies and residents, and the importance of CBD, is likely to remain the same.

Declining semi-industrial city. In the sixth cluster there are respondents that do not see any regional or national functions as relevant to their city, but tend to attach, to some extent, industrial characteristics. Their city suffers from severe socio-economic problems. They fear that their city will become less attractive while

competition with other cities will increase. However, also suburbanization and segregation are expected to decrease.

It is important to notice that the membership of each respondent to a cluster represents the way he or she perceives his or her city. Thus, respondents from the same city may belong to different clusters. For example, out of 17 respondents from the German city of Dresden, 5 belong to cluster 2, 6 belong to cluster 4 and the rest were clustered in cluster 5. On the other had, we can find cases where there is more agreement among the respondents. In Berlin, for example, out of 26 respondents, 23 belong to cluster 3 (struggling national-industrial type). The respondents from Monchengladbach (Germany) tend to agree also that their city belongs to cluster 6, declining semi-industrial (13 out of 17 respondents). Nevertheless, even though we can find cases where the respondents agreed about the image of their city, in most of the cases the perception of the city is not unambiguous. As mentioned earlier, the perceived city is the one that the decision-maker is making decisions for. Hence, it is interesting to see that decision-makers from the same city have different pictures of their reality in mind and different expectations on the future. They may, as the model hypothesized, also have different assessments of the relevance of ICT policies to their city.

As a conclusion, the various types of imaginable city distinguished above mirror the views of each respondent, allowing us to use this variable as an indicator for the perceptions of the urban decision-makers.

4. Opinions about ICT

In a way similar to the previous section, we have also tried here to create prototypes of opinions about ICT. Here, there are two dimensions associated with the latent variable for ICT opinions. The first dimension is concerned with the assessment of the respondents about the effects of ICT on future trends. The questionnaire listed the same future trends presented in Box 4 and asked the respondents to evaluate how much influence ICT will likely have on these trends (high, medium, low, none, and DK). The second dimension is based on a list of statements (presented in Box 5) through which the respondents were asked to indicate their degree of agreement in regard to that statement.

Box 5: statements regarding ICT

ICT will change the policy-making process in our municipality;
ICT improve communication within our city administration.
ICT improves the ability of our city administration to serve the citizens;
ICT improve citizen access to *useful* information.
ICT gives the administration better access to public opinion;
ICT will increase citizen participation in the policy process;
ICT provides all segments of the population with equal access to education, employment and social services;
ICT increases even more the gaps between poor and rich;
ICT enables people to get better access to professional services without living in a city;
ICT enables people to get better access to urban cultural life without living in a city;
ICT will reduce the need for people to travel;
ICT improve the quality of social relationships.

Table 4: Factor-variables for opinions on ICT based on factor analysis*

Title of the meta-variable	Variables included in the meta-variable
Factor 1: Administration and ICT: changes in the administration and its relationships with citizens	Changes the policy making process Changed policy making process Improves the ability of our city administration to serve the citizens Improve citizen access to *useful* information Gives the administration better access to public opinion Will increase citizen participation in the policy process
Factor 2: ICT effects on urban trends	CBD importance Suburbanization Social segregation Traffic flows Effectiveness of environment protection (Potential to attract residence)
Factor 3: ICT effects on strengthening trends	Importance of the city Potential to attract service companies Potential to attract industrial companies Potential to attract residence (CBD importance)
Factor 4: ICT and social effects	Will increase citizen participation in the policy process Provides all segments of the population with equal access to education, employment and social services Increases even more the gaps between poor and rich Improves the quality of social relationships
Factor 5: ICT as a substitute for urban features	Enables people to get better access to professional services without living in a city Enables people to get better access to urban cultural life without living in a city Reduces the need for people to travel

*(In parentheses variables that mainly belong to an other group, but are also affecting significantly the current group)

Based on the evaluations of these two dimensions again a factor analysis was performed, identifying five meta-variables as listed in Table 4. (Table A2 in the Appendix presents the component values for the listed variables). These five variables explain 55% in variance of the 21 listed variables.

Here again, the contents of the meta-variables should represent the list of variables that were grouped together in order to obtain meaningful new variables. Based on the factor loadings obtained by the factor analysis, we clustered next the respondents according to their scores into five new variables that represent their opinions about ICT (a process similar to the clustering of perceptions of the city in the previous section). Here 5 clusters were identified, mapping out 5 patterns of relationships between the above five factors. Again here, Table 5 offers an interpretation for the different clusters of attitudes and opinions about ICT, the city and the society:

Moderate scepticism. In cluster 1 we can find respondents that disagree with statements that suggest that ICT will change the municipality structure and its relationships with citizens. They also think that ICT cannot offer a real substitute to urban features. However, they attach to ICT a high influence on future urban trends and on the strengthening of current trends and tend to recognise the positive social effects of ICT.

Extreme scepticism. Cluster 2 includes respondents that expressed extremely sceptic views on ICT. They do think that ICT will neither affect administration

behaviour nor it will have any effect on current urban trends. They do not perceive ICT as socially beneficial, and they have mixed views about the ability of such technologies to offer a substitution to urban features.

Optimistic approach - cluster 3 includes respondents who foresee significant influences of ICT. They think that it will change administrative behaviour and decision-making processes. ICT will also have positive social effects and it will enable people to enjoy from positive urban aspects without actually living in the city. However, there is no clear pattern among the respondents in this cluster with regard to the effects of ICT on different urban trends.

Table 5: Cluster of opinions about ICT

Factor	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
ICT changes administration and its relationships with citizens	.53336 Homogeneous Disagree	1.191577 Homogeneous Strongly disagree	-.87224 Homogeneous Strongly agree	-.49651 Homogeneous Agree-strongly agree	-.54752 Homogeneous Agree
ICT effects on urban trends	-.65361 Homogeneous High	.6368264 Homogeneous Low	-.93476 Homogeneous High	.47865 Tendency Low-none	.39376 Tendency Low-none
ICT effects on strengthening trends	-.61547 Homogeneous High	.965445 Homogeneous None	-.73191 Homogeneous High	.04521 No pattern	.16433 No pattern
ICT and social effects	-.38282 Tendency Agree	.6417488 Homogeneous Disagree	-1.01036 Homogeneous Strongly agree	.32364 No pattern	.37765 Tendency Disagree
ICT as a substitute for urban features	.75333 Homogeneous Strongly disagree	.223412 No pattern	-.45905 Tendency Agree	-1.1753 Homogeneous Strongly agree	.63395 Homogeneous Strongly disagree
Number of observations in clusters	**252**	**322**	**287**	**252**	**261**

Mixture feelings approach. In cluster number 4 respondents who think ICT will change and improve administration behaviour were grouped together. They are the only group that thinks that ICT can offer some substitution for certain urban features. However, they tend to attach to ICT only a low or negligible influence on urban trends, and have mixed views whether ICT will have social benefits or whether it can effect the attractiveness of the city.

Instrumental approach. In cluster 5 we can find respondents that see ICT as influential mainly within the urban administration and its contact with the citizens. They do not think it has positive social influences or that it can replace urban life. Its effect on urban trends is expected to be low.

Analogously to the previous analysis, the cluster that characterises each respondent can be used as an indicator in the decision-maker's perception box. Together with the cluster of the imaginable city, the model can identify each respondent by his or her perceptions about the city and ICT.

5. ICT policies profile

5.1 Goals of ICT policies

Classic public policy-making models describe the rational process of decision-making by identifying the goals that the policy is aiming at. Hence, in order to

characterise the policies that are perceived by the decision-makers, the first dimension is the extent to which various ICT-related goals are relevant to the decision-maker. In our questionnaire we offered a list of possible municipality goals that might be a target for ICT policies and asked to what extent these policies are relevant to their city. Three main goals were identified:

- Economic development of the city
- Improvement of municipality - citizens relationships
- Networking with other cities.

The replies varied from "very much relevant" to "not at all". These three policy goal will be the first dimension of the policy variable. A new variable was created representing the sum of these three variables (ranging from 3 to 12). Low scores indicating that the respondent attached a high relevance to the above policy goals, and high scores indicating less relevance.

5.2 Relevant tools to employ ICT policies.

Though decision-makers may agree about the goals of ICT policies, they may differ with regard to the way they assess the relevance of various measures to achieve them. In our questionnaire we offer a list of possible policy measures and asked the respondents to assess to what extent these measures are relevant to their city. In Box 5 the measures list can be found.

Box 5: ICT measures

Improving telecommunication infrastructure
Promoting or supporting computer availability in public places
Promoting research about ICTs .
Promoting or supporting ICTs training
Supplying municipality information via telecommunications
Promoting municipality services via telecommunication
Promoting ICTs use in the planning process
Using ICTs in transport planning
Promoting or supporting tele-working programs
Promoting or supporting tele-medicine
Promoting or supporting tele-education

Interestingly, a substantial share of the respondents have chosen the option DK with regard to the different options, indicating a lack of knowledge, interest or awareness regarding such policy tools. The size of DK answers (in some cases more than 20% of the respondents) does not allow us to treat these as missing values. Thus, the first indicator for measuring relevant tools as perceived by the respondents is the number of DK answers for each respondent. It can indicate the level of knowledge and awareness of relevant ICT measures. Table 6 presents the distribution of the number of DK responses. It also shows the distinct categories for this measurement, with five levels of awareness.

As a complementing indicator, there is also a variable that indicates how many (out of 11) measures are considered by the respondent, as very much relevant, or to some extent. Also here, the variable was categorised into five levels, where category 0 includes respondents who gave no measure a high relevance, and category 4 includes those who indicated that 7 or more measures are relevant to their city. The above two variables (categories of DK answers and categories of high relevance answers) were

combined into one variable, which ranges from 1 and 8. This final variable represents the degree of awareness and the ability of respondents to identify a wide XXX of possible ICT interventions (where 1 indicates low awareness and 8 implies high awareness).

Table 6: Frequencies of DK answers for ICT measures, and their categories.

Num. of DK answers	Percent	Cumulative Percent	Categories
.00	44.9	44.9	4: No DK
1.00	11.2	56.1	3: 1-2 DK
2.00	10.3	66.4	
3.00	8.7	75.1	2: 3-4 DK
4.00	8.1	83.2	
5.00	5.7	88.9	1: 5-6 DK
6.00	3.4	92.3	
7.00	1.9	94.1	0: 7-11 DK
8.00	1.4	95.5	
9.00	.7	96.2	
10.00	.3	96.5	
11.00	3.5	100.0	
Total	100.0		

5.3 Municipality role

The third dimension of ICT policy, as perceived by the respondents, is the role they assign to the municipality in the ICT area. Some may think that compared to other actors, the municipal role is very limited. Others may assign a high influence of the municipality action on ICT in their city. We have used two questions from the questionnaire to determine what the respondents think about this issue. The first question asked how much influence the municipality has with regard to the application of ICT in the city. The second question used here is the agreement (or disagreement) with the statement that private sector decisions and activities are not affected by municipal ICT activities. The scores on each variable were combined into one variable (ranging between 2 and 8, where 2 indicates low influence of municipality role in ICT and 8 suggest high influence).

5.4 Clusters of ICT policies

Like in the previous sections, after recognising the relevant variables we can now build the policy assessment dimension. Also here, a cluster analysis was employed to identify a relatively homogeneous group of respondents according to their scores on the variables, which compose the different dimensions of ICT policy perceptions. The analysis identified 5 clusters that may represent different approaches towards urban ICT policy. Also here we can identify each respondent according to cluster of the policies that were created.

High-developed and detailed policy. In the first cluster the respondents attach medium relevance to the three policy goals i.e., at least one of the three policy goals was considered to be very relevant. They have knowledge about various ICT measures, while at least few of them are considered to be relevant to their city. They think that the municipality has a medium to high influence on ICT in their city.

Intermediate–developed policy. The second cluster is very similar to the first one, but here the respondents have less knowledge or awareness regarding different ICT measures.

Table 7:5 clusters of ICT policy assessments

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
ICT policy goal: economic, municipality and networking (3:very relevant, 12: not at all)	4.8 medium relevance	4.7 medium relevance	6.5 little relevance	4.8 medium relevance	7.0 low relevance
Awareness of ICT tools (0: none, 8: a lot)	6.9 a lot	4.2 medium	2.5 low	1.2 low	6.8 high
Municipality role (2:not important, 8 very important)	6.2 medium-high importance	6.4 medium-high importance	5.0 low importance	6.5 high importance	4.8 low importance
Number of observations in clusters	**366**	**414**	**213**	**159**	**199**

No policy. The third cluster includes respondents who found the policy goals with just a little relevance to their city. They have a low awareness to possible ICT measures for their city, and believe that their municipality has just little impact on ICT in the city.

General knowledge. In the fourth cluster there are respondents that attach medium relevance to the policy goals. Although they think that their municipality has an important role in the ICT field, they hardly have knowledge about actual ICT measures.

Instrumental approach. In the last cluster we find respondents who do not think that the above three policy goals are relevant to ICT. In their opinion, the municipality has no important role in that field, although they consider various ICT measures relevant for their city.

The previous exercises have allowed us develop a systematic typological analysis of imaginable cities based on the perceptions among urban actors. They represent a virtual reality, but are based on real world experience, views and perceptions.

5. Concluding remarks

This paper has presented a conceptual model aimed at explaining the assessments of ICT policy choices, in particular perceptions by urban decision-makers. Our model aimed to focus on the way the decision-maker perceives his or her city, and his/her opinions about ICT. In order to measure such perceptions there is a need to provide an operational meaning to such perceptions. Thus, the main objective of this paper was to operationalize the concept of the decision-maker's perceptions. Using data from a European survey, we have built three groups of clusters. The first one describes different ways in which the decision-makers perceive their city, the so-called imaginable city. Using 9 meta-variables that represent the main functions of the city, its problems and the expectation for future trends, the respondents were grouped into 6 clusters. These clusters are representing 6 different ways to imagine a prototype city.

The same process was also applied to identify different types of opinions about ICT. Here, 5 clusters were identified, suggesting 5 different attitudes towards ICT and its expected effects on our future society.

Furthermore, an attempt to build the latent dependent variable resulted in 5 different clusters, characterising 5 approaches to assess the relevance of ICT for urban policies, as perceived by the respondents.

Each decision-maker can now be identified by his or her type of city perception, his or her opinion about ICT, and the corresponding ICT-related policy type. Thus, the complex concept of reality perception is simplified into three measurable variables that allow us to operationalize the perception model.

Clearly, there are more variables in the above-mentioned model that would have to be examined and which also call for an operational meaning. The next step in future research is now to develop a more complete multivariate model in order to explain the assessment of different ICT policies and to examine whether different perceptions of the city and ICT account for differences in such judgements and subsequent decisions.

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Annex A: Treatment of "don't know" answers

The vast majority of our questionnaire is based on a Likert scale and offer the option of "don't know" (DK) as a possible answer (assuming that not knowing or not having an opinion on the subject at hand is true). However, since the variables are ordinal in nature, the DK option is problematic, because it is not easy to determine the place of such an answer in the ordered scale. The questionnaire includes 4 types of scales:

1. Strongly agree/ agree/ disagree/ strongly disagree (and DK).
2. Very much/ to some extent/ a little/ not at all (and DK).
3. Increase considerably/ increase to some extent/ no change/ decrease (and DK).
4. High/ medium/ low/ none (and DK).

There are three possible options for treating DK responses: first, in cases where DK answers account for a large share of the answers, it is valuable information that should be taken into account. Then, the analysis can be binary: whether the respondent has or does not have an opinion on the issue at hand. In such an analysis, we cannot use the detailed information about the degree of agreement on issue that was raised. A second possibility is to exclude the DK items from the sample. This option is problematic since many variables are part of a factor analysis. Thus, even if a respondent has just one DK response out of a list of many variables that are included in the factoring process, the analysis will exclude the case. For some cases it reduces even 50% of the sample. We have, as a rule of thumb, decided that when the number of DK answers exceeds 3, the respondent should be excluded from the analysis.

In cases where a respondent had less than 3 DK answers in the relevant variables, it seems reasonable to treat DK answers as missing data, and thus replace DK with a value in the range of the other responses. The argument to treat DK as a missing value is that it may indicate that the respondent that chose the DK option is missing the information necessary to have an opinion. It may, of course, be that if the option DK would not have been provided, he or she might well have left the question blank. Then a simple approach is to replace each DK with the sample mean response. In such cases, we must be sure that the DK responses account for no more than 3% to 5% of the responses. Applying such a technique means that these variables have an ordered four degrees scale, that is suitable for further analysis. For most of the variables, the share of DK responses falls between 0.3%-5%. However, there are some variables with a higher share, and thus such a method cannot be applied for them. In such cases, the above first two options should be applied.

Table A1: Factor analysis for City profile variables

	Extraction	Components of the nine factors								
		1	2	3	4	5	6	7	8	9
An industrial centre	0.698	.0028	.123	-.118	-.110	-.00224	.914	-.00271	.291	-.144
A services centre	0.668	-.111	.789	.00012	.105	-.105	.00387	-.0019	-.00689	.00473
An administrative centre	0.590	-.0022	.784	-.00139	.00101	.00157	-.00623	-.00599	-.109	.00375
A centre of logistics	0.550	-.110	.409	.00273	-.00829	-.00355	.445	.00562	-.123	.192
A centre for tourists	0.617	.0020	.172	.125	.00056	.212	-.373	.568	-.0086	-.00825
A commercial centre	0.570	-.0151	.595	.00758	.00174	.00056	.214	.00103	-.106	.161
An ICT and/or multimedia centre	0.517	.00205	.631	.00582	.00132	-.00526	.00780	.133	.00232	.00766
A centre for higher education	0.627	.218	.778	-.137	-.00892	-.00239	.00018	.00955	.00956	-.130
An important city in the regional context	0.452	.153	.592	-.00294	-.114	-.00378	.00866	.185	.00709	-.136
An important city in the national context	0.718	-.00802	.246	.00839	.106	.00739	.00937	.623	.00493	-.00422
An important city in the European context	0.699	.00411	.157	.00959	.00924	.00661	.00987	.683	.00862	.00387
Traffic congestion	0.448	-.00131	.00836	.00488	.529	.0045	.00513	.144	-.00863	-.300
Housing Shortage	0.645	.373	-.00507	-.00348	.781	.0001	-.00124	.103	.00139	.00244
Lack of land reserve	0.554	-.0016	-.00197	-.00558	.763	-.200	-.00714	-.00266	.00448	.148
Unemployment	0.652	.854	-.00206	.00689	-.00796	-.103	.00249	.00715	.00519	-.116
Decline in the industrial sector	0.618	.804	.00472	.00473	-.0093	-.136	-.00302	.00410	-.154	.109
Ageing population	0.472	.688	.144	.00528	.0073	-.137	-.130	-.167	.00694	-.00764
Sub-urbanisation/ urban sprawl	0.497	.457	.213	-.127	.00285	.381	-.0017	-.00091	.00362	.00801
Decline of the city centre	0.485	.481	.00695	-.00797	.00074	.156	.00500	-.351	.00464	.133
Socio-spatial segregation	0.501	.543	-.00122	.00216	.140	.256	.00573	.00915	.00135	.00523
Problematic real estate market	0.573	.201	.00779	-.0051	.648	-.00362	-.250	-.101	.257	.00860
Lack of open (green) space	0.457	.229	-.00593	.00076	.572	-.00051	.00391	.00765	-.00172	-.126
Negative image of the city	0.563	.472	-.167	.00788	.00696	-.00668	.336	-.235	-.00564	.00995
Pollution	0.530	.216	-.114	-.198	.328	.00715	.483	.00559	.00228	-.128
Budget deficit	0.497	.677	-.0018	-.0017	-.141	.00272	.00374	.00377	-.176	-.00349
Problems in the education system	0.510	.509	-.247	.149	.00894	.00432	.101	.208	-.256	.00828
The importance of our city	0.624	.00014	.00457	.741	.00135	-.105	-.00334	.114	.00457	.00068
Competition between our and other cities	0.634	.0069	.00211	.00677	-.00264	.278	-.123	-.00239	.245	.844
Co-operation between our and other cities	0.450	-.00708	-.00421	.284	.00724	.00575	.00565	.00567	.538	.361
The potential of our city to attract service companies	0.573	.176	.00964	.653	-.00102	-.120	.0010	.00649	.284	.00915
The potential of our city to attract industrial enterprises	0.632	-.00883	-.120	.429	-.133	.136	.274	-.00952	.452	-.226
The potential of our city to attract new residents	0.579	-.00939	-.00579	.752	-.00576	.00288	-.133	-.00404	-.00363	-.00311
In general, the importance of the CBD in our city	0.503	.139	-.00527	.751	-.00298	-.145	-.150	.101	-.00163	.00780
Suburbanisation	0.668	-.160	-.103	-.170	-.00663	.890	.00011	.151	.124	.176
Socio-spatial segregation in our city	0.510	.139	-.00747	-.00809	-.156	.679	-.00503	.00363	-.126	.242
Traffic in our city	0.571	-.00675	.148	.355	.160	.383	.00065	-.413	-.280	-.151
The effectiveness of environmental protection in our city	0.569	-.121	-.00286	.00468	.00468	-.00199	.199	.00748	0.785	.166

Table A2: Factor analysis for opinions about ICT variables

	Extraction	Components of the nine factors				
		1	2	3	4	5
Importance of the city	.581	.126	.0016	.745	-.139	.0011
Potential to attract service companies	.693	.00031	-.118	.888	-.0068	.0070
Potential to attract industrial companies	.422	-.126	.0084	.605	.0092	.0074
Potential to attract residence	.512	-.0054	.332	.410	.203	.0008
CBD importance	.498	-.0055	.365	.341	.219	-.138
Suburbanization	.522	-.127	.787	-.0017	-.100	.120
Social segregation	.632	-.0039	.882	-.109	-.141	-.0038
Traffic flows	.438	.0075	.623	.0084	-.0075	.0039
Effectiveness of environment protection	.398	.182	.523	.0057	.0029	-.127
Changes the policy making process	.391	.484	.134	.156	.0063	-.204
Improves the ability of our city administration to serve the citizens	.584	.783	-.0064	.1443	-.0092	.0043
improves the ability of our city administration to serve the citizens	.698	.871	-.0039	-.0073	-.0087	-.0003
improve citizen access to *useful* information	.633	.790	-.0085	.0027	-.0054	.0084
gives the administration better access to public opinion	.554	.649	.0095	-.0067	.193	-.0008
will increase citizen participation in the policy process	.504	.495	.125	-.144	.354	.0027
Provides all segments of the population with equal access to education, employment and social services	.630	.0014	-.0011	-.0081	.785	.184
Increases even more the gaps between poor and rich;	.446	-.0038	-.380	.117	.654	-.226
Enables people to get better access to professional services without living in a city	.631	.212	-.0076	.134	-.0093	.704
Enables people to get better access to urban cultural life without living in a city	.587	-.0062	-.0054	.173	.106	.758
Reduces the need for people to travel	.439	-.0050	.130	-.161	.141	.626
Improves the quality of social relationships	.494	-.0012	.0028	-.0053	.691	.141