A Classification of European Cities
On the Basis of E-Images

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Information and Communication Technology (ICT) has become a major enabling technology that is nowadays very much 'en vogue'. It has also become an important tool to promote a variety of business goals and public policies. The growing importance of ICT in daily life, business activities and governance prompts the need to consider ICT more explicitly in local policies. The expected benefits from ICT encourage urban policy-makers to formulate proper strategies for public ICT policies. But, what are the urban policy-makers' expectations about ICT? And how do they assess the future implications of ICT for their city? This paper is focusing on the way urban decision-makers perceive the opportunities of modern ICT and its related ICT policy. By highlighting the importance of understanding the decision-maker's 'black box' on ICT, we will address three crucial issues in European cities, viz. perception of the city, attitude towards ICT, and assessment of the relevance of ICT policy. We will give an operational meaning to these three variables by using a survey comprising more than 200 European cities as the basis for a classification of these cities by means of their e-images.
Keywords: ICT policy, public policy-making, urban policies, factor analysis, cluster analysis.

New Pathways for ICT Policy in the City

We have in the past decade witnessed a great euphoria on the strategic importance of ICT. The breakthrough of ICT in all sectors of the economy has indeed induced an unprecedented productivity rise. It has also prompted a wealth of scientific research on the potential and complexity of ICT. Since the mid 1990s we observe also an avalanche of publications on the digital revolution. It has been suggested that we were all going to live in cyberspace, mainly Internet-based. This revolution would not take place everywhere on the globe, but would find its origin in the modern city. Such cities were called digital cities. Clearly, in a virtual world many cities would have to seek for a new competitive position in an e-world by exploiting the potential of new communication technologies. Such cities would have to orient themselves towards new telecommunication infrastructures, new modes of working, living and interacting, and new forms of policy-making (see also Boyer, 1996). This development might even lead to the emergence of various distinct groups of citizens (see Graham and Aurigi, 1997), viz. the information users, the information used,

and the non-plugged population. Clearly, the digital city is not yet reality; it is largely based on visions and beliefs. As a consequence, the possible future of the modern city is often depicted in a narrative way, without a strong analytical and empirical underpinning. Consequently, there is a need for solid and applied research.

The future of our cities in an issue full of speculations. There are nowadays many appealing metaphors trying to capture the futuristic and far reaching consequences of ICT for the city and society at large (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. 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. Needless to say, there are many controversies in this debate. Some policy-makers regard

ICT as the enlightening mechanism that will definitely lead to the transformation of the city from the 'dark ages' to a new cyber-space, where cities turn into e-cities. But others are more modest, and see ICT as an incremental technology that may exert a modest impact on urban life, now and in the future.

It is noteworthy that ICT has become part of the portfolio of competitive assets of cities. 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 et al., 2002a). This paper aims to identify the critical factors that affect the urban decision-maker's assessments of ICT policy for modern cities in Europe.

This is a challenging research task. It should be noted that 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 type of research important analytical questions are inter alia: how are decisions taken, how can policies be explained, which factors affect the policy-making process, and so on. Focusing on this second type of public policy research one may distinguish various background factors that may explain emerging policies according to the above mentioned descriptive approach:

- *Path dependency*: previous policies determine subsequent policies, with minor alternations or adjustments. The notion of path-dependency highlights the fact that the 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*: a new policy tends to meet prevailing constraints 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.

- *Perceptions and attitudes of individual decision-makers*: the chosen policy affects 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 then seen as a consequence of these perceptions.

In this paper, we will focus mainly on the third approach, namely an exploration of the way urban decision-makers perceive their city and its problems. Understanding these perceptions may explain the different ICT policies that are developed in different cities. This will also allow us to pinpoint commonalities and contrasts in urban ICT policies. Starting from this point, we will design a classification scheme for cities in Europe – based on survey work – in order to pinpoint the most characteristic elements of various classes of e-city.
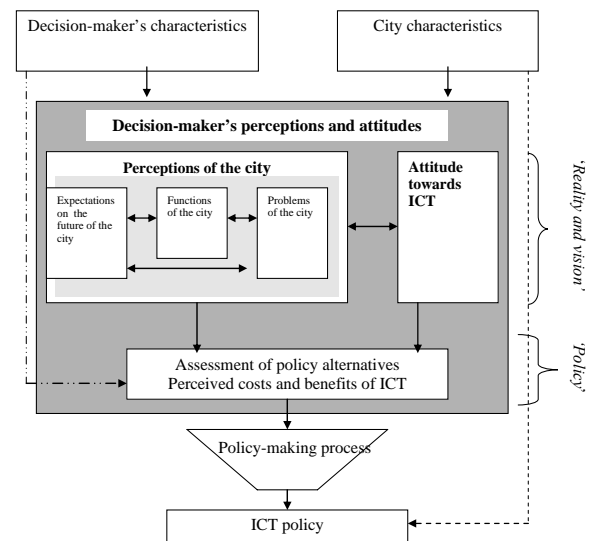
2. Mental Maps of Urban ICT Policy

Modern cities exhibit a high degree of dynamics instigated inter alia by ICT. Cities are fireplaces of economic activity and need to be fuelled by ICT. Information and knowledge have become critical success conditions of cities and regions in a modern economy (Oakey, 1996). It is no surprise that many cities have started to acquire a new ICT-oriented profile in a globalizing and competitive economy (Drennan, 2002).

Urban administrations were keen on this new development and started to design city images which would emphasize the ICT potential of their cities. The question whether or not such images were rooted in reality was in most cases never raised. The only goal of urban policy was to be recognized as a front liner; the external image of the city was a major determinant for policy action. But how can this be studied in empirical terms?

The drivers of urban policy action are not only found in objective facts, but also in subjective perceptions and beliefs in images. The process of policy-making has an uncertain nature, with regard to both the future and the effectiveness of the policies that are implemented (Dror, 1986). Moreover, the assessment of future situations is 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. That is why it is important to understand the way in which a decision-maker constructs the reality on the one hand and values on the other hand. The process of reality judgment and of value judgment leads to action judgment 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, as been said earlier, full of metaphors, it is important to include visions (values) as explanatory factor in the assessment of different policies. This calls for more behavioral and experimental research rooted in the reality of our e-world.

Our paper will address in particular perceptions of urban decision-makers regarding the potential impact of ICT for their city. 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 organizational practice. This calls for a more systemic approach rather than a linear decision model, in which mental maps play a central role.

Figure 1. A decision-maker's mental map of the urban ICT policy-making process

We will now map out the contours of a perception-oriented decision-making model. 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 to the city with a view to the identification of different types of e-cities. First, we will focus on the decision-makers' perception box in order 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 have been dealt with in a more comprehensive study (see Cohen, 2003).

3. Description of the Data Base

The design of a typology of European e-cities calls for applied field work. An empirical analysis of the previous conceptual model is therefore, in order now. 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. 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 normally ICT policies and strategies do not have one recognised responsible agency. In contrast to fields like transportation or education, where there is usually a clear body that is responsible for policies in the field, ICT tends to be a fragmented activity. There is no single clear address in the municipality that is responsible for all relevant information. Thus, it is hard to perform a rigorous empirical analysis in many cases. It is necessary to hold rather costly surveys. A preliminary analysis of the survey held in the Netherlands can be found in Cohen et al. (2002b).

The survey questionnaires contained a variety of ICT-relevant questions for the city. 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 answers to these questions were categorical in nature and thus 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. The survey was rather extensive and led to a rich data base that was suitable for a variety of statistical analyses. More details can be found in Cohen (2003). We will only use a selected subset of the data in our subsequent analysis focussed on e-cities.

4. Images of e-Cities

In the present section we will address the findings from our research. For a policy-maker, the city is partly a mental construct. The city, as the decision-maker perceives it, is actually the city that he or she is making decisions on. But each city has some intrinsic features. We have developed here a taxonomy based on three main profile elements of the city: Main functions of the city; Dominant problems of the city; Expectations on future developments of the city.

Based on opinions and perceptions of these three urban profile elements – as expressed in the survey by our interviewers - , we aim in the sequel of this paper at creating a so-called 'imaginable city', an artificial construct of the e-city seen through the eyes of the decision-maker, which forms the action ground for ICT policy. The perception of all three dimensions of this e-city is based on a series of urban functions and problems that the respondents were asked to evaluate, in particular the extent to which these are relevant for their city. Moreover, the respondents were asked to express their expectations on the nature and direction of various urban trends in ten years from now. This Europe-wide experiment led to a large multivariate data base of some 200 cities, with many distinguishing features according to the approach outlined above. This large multi-variate data base can now be treated with proper classification and cluster techniques so as to derive statistically meaningful e-images of the cities concerned. Therefore, we have performed a factor analysis in order to create an organized structure in our data on European cities. Given the multivariate data base, a standard factor analysis was performed to examine

whether we can identify fundamental underlying variables. Grouping the variables according to their factor loadings will lead to a new set of interdependent meta-variables (i.e. factors) that are best representing all relevant variables in the group. Table 1 presents the group of variables that were obtained by the factor analysis as well as the results and the interpretation for each group. The nine factors appear to explain 57% in the variance of the 37 variables in our sample on the 200 cities.

We will now concisely describe the results. The results suggest that the goodness-of-fit of the model is acceptable, but not extremely good. Nevertheless, there are only a few variables that belong to more than one factor group, which 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 representing the urban profile.

The next step in the analysis is to examine whether we can identify groups of respondents according to their perception of the city. We have clustered our observations according to these variables to identify various types of 'imaginable cities', cities whose features were composed on the basis of perceptions expressed by our respondents. The first step was a hierarchical cluster analysis; the second step used the clusters that were found in the first step as initial centre points for a k-mean cluster analysis. Here, the number of clusters is determined a priori. 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 district clusters could be created, representing six different perceptions (mental maps) of the city. The above results offer a taxonomic interpretation of the clusters which are to be seen as 'prototype cities'. The following taxonomy appeared to emerge:

- *Perception 1: optimistic industrial city.*

Respondents tend to see their city as having mainly industrial functions and 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 service companies and its importance of its CBD, as well as will improve in other positive respects. They also tend to anticipate an increase in competition with other cities.

- *Perception 2: multi-functional optimistic city*.

Respondents tend to think that their city has a multiplicity of functions: national and regional, and to some degree also industrial functions. There are only a few socio-economic problems and no spatial problems at all. So, 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).

- *Perception 3: struggling national-industrial centre.*

Respondents 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 all agree 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.

- *Perception 4: crowded-developed regional centre.*

Respondents believe that their city has mainly regional functions. In addition, there is a 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 also believe that the ability of their city to attract firms and residents will increase significantly while the competition with other cities will remain the same.

- *Perception 5: stable semi-national city.*

Respondents think that their city has no industrial functions at all and limited national

functions. These cities have, to some extent, various 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.

- *Perception 6: declining semi-industrial city*.

Respondents 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. More details on this statistical experiment can be found in Cohen (2003).

Table 1. **Profiles of e-cities based on factor analysis**

Factor	Constituent variable
1: socio-economic problems	Unemployment Industrial decline Aging population Suburbanization Decline of CBD Social segregation Negative image Budget deficit Education problems
2: regional functions	Service center Administrative center Commercial center ICT center Education center Regional importance
3: attractiveness trends	The importance of the city Potential to attract service companies Importance of CBD
4: spatial problems	Traffic congestion Housing shortage Lack of land reserves Problematic real estate market Lack of green areas
5: suburbanization and segregation trends	Trend: Social segregation Trend: Suburbanization
6: industrial functions	Industrial center Logistic center Pollution problem

Factor	Constituent variable
7: national functions	Tourist center National importance European importance
8: positive trends	Co-operation among cities Effectiveness of environmental protection Potential to attract industrial companies
9: competition trends	Competition among cities

5. Attitudes towards ICT in e-Cities

On the basis of the distinct mental maps of e-cities, we have tried 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. Here, we may distinguish 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 and the second dimension refers to their degree of agreement in regard to that statement. Based on the evaluations of these two dimensions again a factor analysis was performed, identifying five meta-variables (see Table 2). These five variables appear to explain 55% in variance of the 21 listed variables.

In a way analogous to the previous exercise, we clustered 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 of prototypes of 'imaginations' of the city could be identified:

- *Attitude 1: moderate scepticism.*

Respondents 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.

- *Attitude 2*: *extreme scepticism.*

Respondents 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.

*Table 2. **Opinions on ICT on e-cities, based on factor analysis***

Factor	Constituent variable
1: ICT and administration: changes in the administration and its relationships with citizens	Changes the policy making process
Improves the ability of our city administration to serve the citizens
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
2: ICT effects on urban trends	CBD importance
Suburbanization
Social segregation
Traffic flows
Effectiveness of environment protection
3: ICT effects on strengthening urban trends	Importance of the city
Potential to attract service companies
Potential to attract industrial companies
Potential to attract residence
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
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

- *Attitude 3: optimistic approach.*
Respondents think that ICT will change administrative behaviour and decision-making processes an 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.

- *Attitude 4: mixture feelings approach.*
Respondents think ICT will change and improve the administration's behaviour and that ICT can offer a 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.

- *Attitude 5: instrumental approach.*
Respondents 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.

6. ICT Policies Profile in e-Cities
How does policy respond to the above findings and facts? In this section we will address these policy questions. The third variable in our data base concerns the assessment of the relevance of ICT policies as perceived by the decision-maker. Like in the previous cases, this variable contains various dimensions. These are listed below:

- The perceived goals of ICT policies

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. The three main goals identified here appeared to be economic development of the city, the improvement of municipality - citizens relationships and the networking with other cities.

• The perceived 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 offered a list of possible policy measures and asked the respondents to assess to what extent these measures are relevant to their city. A substantial share of the respondents have chosen the option DK (Don't Know) 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 and we assume that a DK answers indicate the level of knowledge and awareness of relevant ICT measures.

• The perceived role of the municipality with regard to ICT activities in the city

In the view of some respondents, the municipal role is very limited, while others assign a high influence of the municipality action to ICT in their city. We also asked decision-makers how much influence the municipality has with regard to the application of ICT in their city and their agreement (or disagreement) with the statement that private sector decisions and activities are not affected by municipal ICT activities.

After identifying the relevant variables we can now, like in the previous sections, build the policy assessment dimension. Also here, a cluster analysis was employed to identify a relatively homogeneous group of respondents regarding the different dimensions of ICT policy perceptions. Also here we can identify each respondent according to cluster of the

imaginable policies that were created:
• *Policy assessment 1: high-developed and informed policy profile.*
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.
• *Policy assessment 2: intermediate–developed policy profile.*
This cluster is similar to the first one, but here the respondents have less knowledge or awareness regarding different ICT measures.
• *Policy assessment 3: no policy profile.*
Respondents 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.
• *Policy assessment 4: general knowledge.*
Respondents 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.
• *Policy assessment 5: instrumental approach.*
Respondents 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.

7. Concluding Remarks
Modern ICT prompts imagination, but needs solid research work. The previous exercises have allowed us to develop a systematic typological analysis of the decision-maker's perception and attitude on urban ICT policy. The results represent a virtual reality, but are based on real-world experience, views and perceptions. 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 of e-cities. The first one describes different ways in which the decision-makers perceive their city, the so-

called imaginable city. The second one was applied to identify different types of opinions about ICT, while the third one focused on the assessment of the relevance of urban ICT policy. 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 derived from Vickers' black box.

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. Such new experiments might also lay the foundation for appropriate scenario exercises on urban futures.

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