Tripple bottom line effects of accelerated ICT maturity in worldwide cities
--- Citizens’ Index ---

NETWORKED
SOCIETY
CITY INDEX

PART II

Triple bottom line effects of accelerated ICT maturity in worldwide cities

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1. INTRODUCTION AND AIM OF THE STUDY

This study by Ericsson in cooperation with Arthur D. Little is the second in a series of three (City, Citizens and Business) within the context of developing a comprehensive City Index capturing the triple bottom line benefits of Information and Communications Technology (ICT) from three different perspectives. The focus of this study is ICT derived benefits for citizens. Ericsson will complete the picture of Networked Societies by addressing one additional dimensions of city development: the Business Index.

In part one of this series of three, 25 large cities were selected for in depth study. The selection was made based on the United Nations list of largest cities with the addition of the capitals in the two leading nations in the Networked Readiness Index, published by the World Economic Forum. The addition is made with the purpose to ensure that cities with a strong ICT development are captured in the study.

Through the “Networked Society City Index”, Ericsson aims to contribute and inspire to the development of Networked cities around the world. A networked society is at the forefront of ICT development, successfully using ICT as a tool to drive triple bottom line development (social, economic and environmental).

We recognize the importance of an effective policy framework in the sustainability arena but this is not the intention in this report nor is it a scientific report, but an invitation to a joint journey to explore the link between ICT and triple bottom line development in city environments. It is the hope and intention that this series of reports will inspire city mayors, decision makers and business parties to create stimulating city environments and set positive reinforcing cycles in motion with the help of ICT.
The “Citizen’s index” has been calculated based on an Ericsson analytical framework in cooperation with Arthur D. Little with input data collected from Ericsson market research, publically available sources including a large number of business articles, statistical analysis and academic reports. Key sources include:

- Statistical data from international organizations (e.g. OECD, UNHCR, UNDOC, WHO, IMF and IEA)
- Statistical data from national and city/regional statistical offices
- Academic studies and reports
- Business papers from leading management consultants (e.g. Arthur D. Little, McKinsey & Company)
- Data analysis by independent research houses (e.g. Gartner, PWC)
- Research conducted by Ericsson ConsumerLab and Ericsson Research

There are multiple reasons why cities merit closer investigation:

- Firstly, cities represent a more universally comparable context than the more commonly used nation-based frameworks. Comparing London with Shanghai makes more sense than comparing the UK with China. A city focus therefore provides opportunities for faster understanding and global best-practice sharing.

- Secondly, cities are already home to more than half the world’s population, and more than 50 percent of global GDP generated in the largest 600 cities. As a part of the development ahead, cities will increasingly benefit from effective ICT strategies to be implemented across a multitude of stakeholders in order to meet the needs of social, economic and environmental development.

- Finally, the city index framework provides city mayors, local authorities and decision-makers with a tool to measure and analyze their cities’ ICT maturity, as well as the triple-bottom-line benefits of their ICT investments.

Ericsson invites city level authorities, citizen representatives and others to engage in discussions on how to best use ICT investments to serve the city, its citizens and its businesses from a triple bottom line perspective. Hopefully this initiative can serve as one humble inspiration point for one of mankind’s greatest endeavors today namely the continued journey towards the Networked Society.
2. EXECUTIVE SUMMARY

Successful cities excel at attracting ideas, capital and skilled people. Such positive attraction requires constant progress in economic terms as well as within a social and environmental context.

To create positive, reinforcing cycles encapsulating all necessary ingredients for triple bottom line development (social, economic and environmental), city mayors and planners should investigate the finer mechanisms in place not only from a city perspective but also on a business and individual level. This sequel in Ericsson’s networked society city index series focuses on the citizen perspective. Indeed, the individual citizen’s level is crucial perspective to investigate. A city that is not attractive in the eyes of the citizen, stands a high risk of decline over time.

Earlier in 2011 Ericsson in cooperation with Arthur D. Little presented a Networked Society - city index report that maps the ICT maturity of 25 of the world’s largest cities to the society benefit created.

The overall findings from the first report of the index, was as follows:

› There is a connection between ICT maturity in cities and triple bottom line development – especially from economic and social development

› Cities at different stages of ICT maturity should apply different strategies in order to maximize ICT-driven advancement.

› In the first report, Singapore was rated as the best performing city followed by Stockholm, Seoul and London.
In this second release, Ericsson now provides the citizen view, highlighting the benefits of ICT from the citizen perspective in the same major cities worldwide. The rating is based on the ICT maturity scale that was developed in the first release, whilst the benefit rating is now geared at capturing the triple bottom line benefits of ICT to the citizens. This represents the ICT enabled improvements from living in the city and relates to areas such as health, education, economic gains and city efficiency as well as citizen’s ICT behavior that carries environmental improvement. To best capture this, we have used a broad set of indicators based on publicly available quantitative data and qualitative case studies based on Ericsson ConsumerLab research and published sources.

We can now reveal how the initial 25 cities from the first part of this sequel as ranked from the citizen’s perspective. See chart below.
A set of conclusions may be drawn on how ICT enables personal benefits:

- People in leading cities exhibit a high degree of utilization of digital services to enrich daily life and entrepreneurial activities.

- In particular in the field of digital inclusion emerging cities demonstrate ICT initiatives with strong individual benefits such as Delhi’s one-stop service centers.

- High rated cities realize potential by opening up for local innovations to benefit citizens. Although high level challenges may be shared for many cities, local conditions vary and the citizen’s energy and creativity should be engaged in local solutions.

For the environmental dimension we see that increased ICT maturity leads to changing citizen behavior with impact on reduced environmental pressure from transportation and service usage. As increased GDP per capita often is equal to increased pressure on environment from changed living and thus increased consumption behaviors. The environmental part of this index indicates how ICT can support to reduce from a certain level of pressure on the environment, for example, how a city with high GDP could use ICT to reduce their total environmental pressure, or conversely, how a developing country or city can chose a more sustainable development path, by obtaining the same type of services, but e.g. virtually, as opposed to physical products. Examples could be substituting transportation and materials with virtual meetings, virtual media. With these changes there is a potential to decouple economic growth from environmental impact. Technology exists to deliver services more effectively and already in 2008 the GeSI Smart 2020 report outlined CO2 emission reduction of 15% across society in 2020 through a focused usage of ICT. Progress so far is limited as change supporting policy frameworks are lacking. Adding to the policy need targeted initiatives with focus on open innovation and citizen participation provides another interesting path of development to capture large scale momentum.
Globalization and rapid technological change have made knowledge and education a critical determinant of competitiveness in the world economy. Here, affordable broadband access and ICT also enables new and innovative ways to distribute information and knowledge in e-education settings, using scalable and cost efficient delivery methods. From free-to-use applications such as iTunes University to advanced distance-learning platforms such as The Open University Learning Space, ICT can empower citizen's human capital and potentially allow developing cities to leapfrog to the knowledge economy.

Taking advanced e-government applications to increase citizen's participation in city politics to the next level is another opportunity as has been done in Seoul. For high ICT maturity cities, enabling citizen's self-fulfillment, creativity and entrepreneurial drive foster new smarter solutions for both economic social and environmental benefits. Initiatives such as mobile work centers could help unlocking the transformative power of ICT for environmental benefits. In developing local initiatives, open source and open platform may be preferable to “walled gardens” in order to engage a broad set of contributors.

What a city should do to increase positive reinforcing cycles (social, economic and environmental) from acitizen's perspective depends on its level of ICT maturity. Specifically:

- For high ICT maturity cities, partnerships can be used to enable, encourage and empower citizen initiatives. This ranges from providing open source applications and integration opportunities for developing smartphone apps e.g. for making public transportation a more preferred solution among citizens. Also among the high ICT maturity cities, important challenges remain where options for ICT enabled progress should be analyzed e.g., Los Angeles in reducing its carbon footprint, Beijing in reducing smog and pollution and so forth.

- Broadband to enable advanced e- and m-health services (which require the highest network reliability and security levels. Distant health services will help to increase access to health and also reduce need for transportation. For example, in Paris, at the Hôpital Européen Georges Pompidou, the COHERENCE (COmponent-based HEalth REference architecture for Networked CarE) system is a comprehensive clinical information system (CIS). The components include a patient record (administration/ discharge/transfer), a health record, and a resource and appointment scheduling components constituting a dedicated health Enterprise Resource Planning (ERP) environment.

- Globalization and rapid technological change have made knowledge and education a critical determinant of competitiveness in the world economy. Here, affordable broadband access and ICT also enables new and innovative ways to distribute information and knowledge in e-education settings, using scalable and cost efficient delivery methods. From free-to-use applications such as iTunes University to advanced distance-learning platforms such as The Open University Learning Space, ICT can empower citizen's human capital and potentially allow developing cities to leapfrog to the knowledge economy.

In the citizen index we have for the environmental dimension focused on ICT enabled progress capturing primarily CO2 emissions for transportation. This is an area where ICT based services and applications are available and where data is available making statistical analysis possible. Furthermore within transportation citizen attitudes, habits and behaviors are stronger drivers compared to individual influence over the effects from areas such as power generation, buildings and industrial processes.
ICT platforms to encourage hot spot solutions in public areas and a good broadband connectivity throughout the city, both for fixed and mobile communications.

› For medium ICT maturity cities, such as Delhi and Sao Paulo, connecting businesses and citizens in these rapidly growing economies can both further the citizen's benefits and help maintain economic growth by improving citizen health, education and productivity whilst lessening the adverse impact on the environment from the rapidly expanding economic activity. M-payments, micro-funds, improved public transportation utilization and efficiency are some initiatives which illustrate this. Opportunities also exist to leverage ICT to develop public transportation to reduce congestion and greenhouse gas emissions.

› For low ICT maturity cities, such as Dhaka and Manila, the overall conclusion from the previous report still holds in that governments should take an active role to “push” initiatives to improve ICT-literacy in parallel to continued ICT investments. Care should be taken to balance citizen and business needs within the constraints of the environment. For example, the substitution from bicycling to more private motorized transportation as income rises may be averted by leveraging ICT to improve city public transportation and maintaining policies to encourage this.
3. THE CITIZENS’ PERSPECTIVE: NEEDS, CHALLENGES AND OPPORTUNITIES

3.1 CITIZENS’ NEEDS

A city prospers if it is attractive to its citizens. Citizens’ needs are evolving: where food, shelter and basic security remains important basic needs we within the city context see that more complex and advanced needs increasingly important to meet in order to continue to attract people on a local, regional and global basis.

With a rapidly growing middle class and as people get their more of basic needs satisfied, attention shifts to e.g., balanced life styles, a rich cultural scene, good transport and transaction facilities, good health also in their senior years, self-fulfillment e.g., in terms of higher education and a clean environment throughout the city. Additional citizen’s needs typically include:

- Control: Staying in control of private and working life, Being in control of what is going on, release from stress
- Immediacy: Being in the moment, not having to plan ahead, seize opportunities
- Involvement: Being updated on what is happening at community/family/work, staying part of the loop
- Belonging: Being part of the social loop, staying connected to friends/family/group
- Capability: Feeling efficient and self-satisfied, being prepared to deal with anything unexpected
- Independence: Being able to move around/explore and not being tied down or restricted to time and place, not having to rely on the help of others, being self-sufficient
- Future: knowing that this place is a perceived as future “proof” for yourself and your children

Communication and the importance of being connected cuts through all aspects of life, ranging from professional performance and creativity to social life and leisure. Mobile phones and computers (as well as TV sets, game consoles and other consumer devices) connected to mobile and fixed broadband networks and the internet has changed human behavior tremendously, as they’re providing new opportunities for people to fulfill their needs and to develop their lives.
3.2 CITY CHALLENGES AND OPPORTUNITIES

The development towards ever larger cities creates additional challenges to fulfill the evolving needs of citizens. For example, cities that have urbanized all or most of the land inside and close to the core of the city need advanced transportation and construction solutions. Concentration of people can, if unmanaged, create serious traffic congestions, pollution, widespread health problems and soaring crime rates. Price inflation may also exacerbate poverty as disposable income decrease with spiraling living costs.

On the other hand, the concentration of people, capital and ideas in mega cities provides unparalleled opportunities for wealth creation and social progress. Increased demands for a clean environment, not only in the cities, but involving total ecological footprints can be turned into an opportunity for development of more sustainable production, transportation and waste management systems. ICT can work as an enabler in handling challenges and grasping opportunities. To see how this is done on a micro level the study has also explored data from Ericsson ConsumerLab with in-depth qualitative data.
4. THE LINKAGE BETWEEN ICT DEVELOPMENT AND ECONOMIC, SOCIAL AND ENVIRONMENTAL DEVELOPMENT FROM THE CITIZENS’ PERSPECTIVE

The relationship between ICT and economic development is a highly researched area and numerous academic research reports as well as case studies underline the positive connection of ICT with economic development. At an individual level ICT contributes both to save money and time by being a more empowered citizen and having greater flexibility as a consumer. Additionally, it allows for increased earnings from economic activities, creation of new jobs and furthers opportunities for improved knowledge levels by e.g. e-learning initiatives. Mobile services particularly in low earning segments enables people to become more entrepreneurial and make more money by for instance reducing the need for middlemen when trading e.g. crops as well as save money by avoiding lengthy travel.
Recent studies concluded that for every 1000 new connections, 80 new jobs are created and for every 10 percent increase in penetration rate, GDP increases by 1 percentage point, all else being equal. Doubling of connection speed is further found to yield a 0.3 percentage points increase in GDP from studying data on 33 OECD countries 2008-2010. These findings, along with a body of previous research both empirical and scenario based, highlights an established positive link between ICT and socioeconomic development.

The understanding of ICT’s ability to drive change for environmental progress to society are compared with the disciplines of capturing social and economic benefits relatively new. It is not without progress in terms of creation of needed policy frameworks and proven concepts with ability to generate environmental results but still large scale behavior change and usage limit the benefits achieved so far. Indeed, increased economic output (GDP) is typically associated with an adverse environmental impact. Even though increased income levels may enable citizens and cities to increase care and change behavior to improve the city environment, using comprehensive measurements including the indirect environmental impact reveal that increased consumption result in increased environmental strain elsewhere in the world.

However, in contrast to many traditional infrastructure investments, ICT enables three key advantages to further a reduction in the environmental impact of human social and economic activity. Firstly, ICT enables standardization, monitoring and accounting of energy consumption and other environmental related impacts. Secondly, it enables rethinking and optimization of processes and production methods to reduce e.g. energy consumption and other environmental impacts. Thirdly, and most importantly, ICT allows for radical transformation through e.g. new behaviors, dematerialization of consumption and production. As shown in Figure 1, below, ICT enables teleworking, improves the quality of public transportation through travel planning and productive commuting time, as well as enable dematerialization by substituting physical with digital consumption. The combined effect of ICTs transformative power is considerable. In 2008, The Climate Group on behalf of the Global e-Sustainability Initiative (GeSI) found that ICT could enable emissions reductions of 7.8 Gt CO2e in 2020, or 15% of business as usual emissions in 2020.

At individual level examples of ICT enabled environmental benefits are presented in several cases studies. In Kenya a Mobile Money solution (ICT enabled distant transactions) is expected to reduce carbon emission by a ratio of 1:65 over a 20 year period and in Zagreb a new Healthcare Networking Information System holds the potential of reducing carbon emissions with a ratio of 1:45 over the same period. In both cases ICT plays a significant role for reduced travels and vehicle use. These are examples of cases that have inspired us to extend the analytic framework along the broader areas of triple bottom line benefits.

At this point it is appropriate to note the risk of “rebound effects” from ICT use. For example, the gains in productivity from leveraging ICT in production processes and improved logistics of goods may lead to decreased retail prices. This in turn could, all else being equal, increase consumption and thereby increase consumption-related emissions. To counteract this rebound effect, cities should employ a comprehensive ICT strategy do create the required incentives and initiatives to encourage citizens to change consumption patterns towards reducing their total impact on the environment.

In general, socioeconomic science and corresponding cause and effect relations are complex and intertwined. Effects in one part of a society produce effects in other parts of the society through a complex web of linkages and interdependencies. The effects of ICT on society are a part of this complexity; the exact dynamics of how and to what extent ICT development affects societies are hard or even impossible to understand in full detail. However, there is a large and well-grounded global base of research studies and cases regarding the effects of ICT on society, which is analyzed and continuously investigated within Ericsson. Some observations from this review in the citizen’s perspective are summarized in Figure 1, on the next page.
## Social Dimension

- Improved possibilities in flexibility and time management
- Improved communication possibilities and extending of social network
- Improved richness of communication
- Access to a world of content
- Knowledge and learning capabilities
- Health services and health related information
- Improved publishing and opinion capabilities

## Economic Dimension

- Increased possibilities to set up a business
- Increased possibilities to collaborate with the whole world
- Increased possibilities to stay competitive and take on new jobs
- Jobs created by ICT
- Save time and money by checking prices
- Feeling capable of improved possibility for economic related information as well as online banking

## Environmental Dimension

- Improved possibilities for flexible working. Telecommuting and collaboration
- Improved possibilities for distant communication including virtual presence
- Improved possibilities for travel planning, optimization and usage of travel time
- Digital services aid the process of dematerialization
- Improved possibilities for people to better engage in their environmental impact

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**Figure 1.**
ICT derived impact on the economic, social and environmental dimensions of citizens.
5. OBSERVATIONS FROM 25 GLOBAL CITIES FROM AN INDIVIDUAL’S PERSPECTIVE

Ericsson ConsumerLab has interviewed citizens around the globe regarding their ICT use, personal experiences, professional development, economic prosperity and many more factors related to the individuals’ situations. In these interviews, a link between ICT use and a person’s ability to develop and reach a more advanced state of their full potential emerges. While these interviews are documented at length, example case studies include:

› Omer, a 33 year old logistics manager, juggles seven different drivers all delivering food to over 100 local restaurants. Mobile broadband has made it possible to run this business on the fly throughout the business day rather than catching up in late evenings or early mornings. So, not only has mobile broadband made his working day more effective, but also improved his work life balance

› Sarah, a 44 year old business administrator uses the city car club (CCC) as a complement to public transportation and taxis. This means that she has no need for owning a car which frees capital for her and saves the environment

› Helen, a 24 year old CEO of a family business finds time to connect with her large group of friends and relatives locally and globally on Facebook and other social media late at night after work. In spite of a hectic life that is not always in sync with her social network she can interact regardless of the time of day.

› Michael, a 38 year old electrical engineer monitors and manages his summer house through a variety of ICT tools such as iPhone (controlling the air heat pump), an IP camera (showing temperature inside and outside his summer house), remotely controlled cameras (monitoring safety)
6. TOP CITY OBSERVATIONS

All of the top cities excel at using ICT as an enabler for triple bottom line development, thus attracting new citizens from the countryside, from neighboring cities and from abroad. However, their specific mix of using ICT varies. Specifically:

**Seoul’s citizens enjoy high leverage from ICT with high adoption of digital services**

Seoul is the global leader characterized by high ICT maturity and excellent ICT leverage. Seoul has been successful in all three dimensions and especially in the social dimension with high utilization of digital entertainment and high quality of life with regards to health, security and life satisfaction.

By means of a holistic city planning including ICT as a key component, Seoul offers its citizens unmatched access to digital services for social, economic and environmental benefits. For example, the OASIS Online Policy Suggestion System enables citizens to contribute ideas about city policies and to discuss suggestions directly with city officials. The ideas suggested by citizens through OASIS follow three stages to become city policies: first, the idea is reviewed through online discussions, with the participation of public officers, experts and citizens; second, the idea is reviewed through offline meetings between the citizen who proposed the idea and policy-makers in order to expand the proposal and to establish feasibility; and finally, the idea is implemented into policy.

Moreover, South Korea is the home for more than 20,000 public PC gaming rooms, or “bangs,” which attract more than a million people every day. In South Korea, competitive gaming is a televised sport. Indeed, the Federal Ministry of Culture and Tourism has even established a game development institute. The high prevalence of computer gaming in of Seoul, relative to many other cities, creates great entertainment benefits to both players and audience; this is one clear leverage from ICT. However, the gaming culture is also indicative of the widespread and underlying acceptance and adoption of new technologies.

Moreover, in 2004, Seoul launched a transformation program to “smartify” its public transportation system. By employing advanced ICT technology and a public-private joint approach, the transformation involved digital, physical and institutional integration. The result was improved availability, utilization and timeliness of city public transportation system. Certainly this has contributed to Seoul citizens being amongst the most prone to use public transportation, reducing their environmental impact. This is also part of Seoul city’s energy agenda to reduce the city’s total energy consumption by almost 20% until 2020.

Seoul is not content on past victories however, and is now looking ahead and planning to implement a new Smart Transportation Program. This includes Mobile Work Centers (converted municipality buildings) to enable teleworking, smart pricing systems for transportation demand management, connected busses for improved citizen experience, and a personal travel assistant for improved transportation planning. These initiatives explicitly aim to change the work and life pattern of citizens. Given the technology friendly culture of Seoul citizens, they have a good chance to succeed and could prove a valuable example for other high-ICT cities to follow.
Citizens in Singapore derive benefits from the city’s long-term ICT strategy and digital inclusion programmes

In 2006 Singapore’s Infocomm Development Authority established a holistic strategy to attract foreign investment and sustain long-term GDP growth through the ICT industry, called the iN2015 plan. The strategy aims to build Singapore into an Intelligent Nation and a GlobalCity powered by ICT though infrastructure development, industrial and sector development and knowledge formation. Whilst this plan was aimed towards attracting foreign investments, citizens also benefit from this.

A key ICT benefits for Singapore’s citizen is the possibility to tighten the link between citizens and public authorities. Part of iN2015, the Gov 2015 Master plan envisions to create a collaborative government platform positioning the public sector as a service provider. A large range of programs support this vision towards citizens. For instance, mGov@SG is a one-stop mobile website aggregating 40 different government services for citizens and businesses in various categories from education to employment and defense. One Inbox is an online platform where individuals and businesses can receive all their government-related correspondences electronically. A key element of Singapore's digital inclusion strategy is Citizen Connect centers. The Citizen Connect centers allow citizens without access to the internet to use learn and benefit from e-government applications by providing free access at Community Clubs. This is the result of government citizen cooperation as part of the Government's ongoing efforts to promote e-Services available to all citizens, by the Ministry of Finance (MOF), People's Association (PA) and its grassroots organizations. Originally launched as a pilot community project called 'CitizenConnect', the project aims to provide an easy and convenient means for the public to transact with the Government through the Internet. Among the 1600 Government services available, residents can pay government bills, renew and apply for HDB or URA season parking tickets, pay for library fines, apply for business licenses or even find out more government policies, such as the baby bonus, at Citizen Connect, without needing to travel far. Citizen Connect is currently available through over 20 Community Clubs, city-wide.

Stockholm’s citizens derive benefits from the city’s long-term ICT strategy and digital inclusion programs

The City of Stockholm sees ICT as a major enabler for citizens’ wellbeing and is therefore a prioritized development area. In particular, ICT is seen as an enabler to research collaboration and knowledge transfer. A particularly illustrative example is the currently ongoing integration of three major universities into one larger knowledge area.

Stockholm also establishes Smart City areas with ICT as a major engine for green development, such as the Stockholm Royal Seaport project, including trials on smart grids. E-services are a prioritized medium to ensure increased service availability and cost reduction. Ericsson, together with TeliaSonera and Swedish ICT are developing selected proof concepts on how different ICT solutions such as substituting and optimizing transportation, virtual meetings and healthcare solutions can contribute to the overarching sustainability goals of Stockholm Royal Seaport.

Smart transport is also a clear area of focus in Stockholm. The city has for instance been driving successful congestion charging since 2007. Inspired by the London scheme, the program resulted in its trial period in a traffic reduction of 20% and an emission reduction of 14%.

The use of environmentally friendly means of transportation is also supported by ICT. Stockholm City Bikes (SCB), the City's smart bike rental system is one of many examples of the municipality’s ICT usage to leverage social and environmental conditions. Stockholm City Bikes is a partnership between the city of Stockholm and Clear Channels. The cost of its implementation and operation is fully covered by advertising revenues and user fees. SCB has developed the Near-by-Station system, a tool providing real-time information on available bikes and parking places. It can be accessed online, via smartphones or on terminals located in each station. SCB is integrated with the other public transport solutions in the city, such as Stockholm public transport card and the online traffic information platform Trafiken.nu. The project is part of an overall ambition to develop bike usage in the city, with a SEK 200m investment budget planned for every year until 2018.
London is moving beyond its leading position in the economic dimension and further the integration of ICT in citizens’ habits by becoming a cornerstone of digital innovation and ICT development.

The city encourages market-driven WiFi development, with more than 15,000 private hot spots now installed. The East London’s Tech City project is also a clear illustration of this ambition to become a center of digital excellence. Modeled on the Silicon Valley, Tech City is a planned technology hub in the area of East End between Old Street and the Queen Elizabeth Olympic Park in Stratford.

150 companies have already settled in the area during the last three years and the Prime Minister David Cameron announced in November 2010 a £400m funding plan to develop the area further. Major global players are engaged to create a flourishing digital hub with high speed broadband, innovation centers involving several eco-system players as well as academia and research centers.

- **BT Group** has agreed to accelerate the roll-out of superfast broadband in the hub area
- **Cisco Systems** has agreed to establish an Innovation Centre focusing on technical excellence
- **Google** will refurbish a 25,000 sq. ft. building to serve as a training workshop for ICT start-ups
- **Other major players include** Vodafone, Barclays, Facebook, Telefonica, Intel and Imperial College

Creating digital excellence is however not the only priority in London and numerous initiatives contribute to increasing the digital inclusion of citizen with limited access to ICT. “Connected Communities” is a community wireless project of Superhighways aiming to help digitally excluded residents on a local estate getting connected to the Internet through a freely available community wireless service. Volunteers from the local estate help to set up the service and make refurbished computers available to residents without a computer. “Silver surfers” and “Digital Unite” are two initiatives aiming at allowing seniors to discover how the Internet and ICT can enhance their lives.
7. KEY RESULTS

Ericsson has performed a comprehensive study of 40 indicators according to the methodology described in an appendix to this report. The analysis has been conducted for 25 cities worldwide.

The Citizen’s Index (Figure 2) summarizes the result of the analysis. All 25 cities have been plotted according to their ICT maturity (x-axis) and the corresponding triple bottom line leverage from ICT (y-axis).

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Figure 2.
The Life of Citizens Index ranking.
The cities represent large parts of the world with varying levels of development and are consequently spread across the ICT maturity curve. Cities located in Northern Europe, North America and parts of East Asia have a longer track record of investing in ICT and consequently score higher in the maturity dimension. Three ICT maturity clusters can be identified with Singapore, Stockholm and Seoul leading the high maturity group, Sydney, Buenos Aires and Istanbul leading the mid maturity group and Jakarta leading the group with lower maturity.

A position above the trend line, which is the case for cities like Seoul, Singapore, Tokyo, and Mexico City would indicate that the combined effect of the different players' efforts in these cities has a high focus on creating individual leveraging from ICT investments made. However players in cities placed far to the left, like Sydney and Mexico City could gain additional benefits from driving increased ICT maturity. Correspondingly a position below the trend line which is the case for cities like Karachi, Delhi and Moscow would indicate that actors in these cities are more focused on developing the ICT infrastructure as such, and should as a next step focus on broader leverage from investments made.

From the quantitative data and qualitative analysis the following conclusions can be made:

**Strong connection between ICT maturity & triple bottom line benefits**

There is a strong correlation between ICT maturity and performance on triple bottom line benefits also from the citizen's perspective, especially for the social and economic dimension. For the environmental dimension we see that increased ICT maturity leads to changing citizen behavior with impact on reduced environmental pressure from transportation and service usage. As increased GDP per capita often is equal to increased pressure on environment from changed living and thus increased consumption behaviors. The environmental part of this index indicates how ICT can support to reduce from a certain level of pressure on the environment, for example, how a city with high GDP could use ICT to reduce their total environmental pressure, or conversely, how a developing country or city can chose a more sustainable development path, by obtaining the same type of services, but e.g. virtually, as opposed to physical products. Examples could be substituting transportation and materials with virtual meetings, virtual media. With these changes there is a potential to decouple economic growth from environmental impact. Overall the pattern found in the city perspective analysis is also confirmed in this citizen analysis.

**Triple bottom line score increases proportionally to ICT maturity across the range of cities**

Within the studied cities there is no sign of decline in triple bottom line leverage for cities with higher ICT maturity; implying that even the most developed cities in terms of ICT maturity would benefit from continued investments in ICT.

**Smart cities leverage the potential of broad engagement to bring benefits to citizens**

Best practice cities across the range of ICT maturity display successful public-private partnership initiatives. The importance of engaging the whole of society to realize transformative benefits from ICT is highlighted by Seoul as well as Delhi and Manila using partnership models to deliver change. This highlights how ICT investments need carefully thought through strategies and participation to be successfully implemented.

For high ICT maturity cities, partnerships can be used to enable, encourage and empower citizen initiatives. This ranges from providing open data sources for applications and integration opportunities to developers of smartphone apps for e.g. public transportation planning or advanced e-government applications for taking citizen participation in city politics to the next level such as in Seoul. For these cities, enabling citizens' self-fulfillment, creativity and entrepreneurial drive to foster new smarter solutions for both economic social and environmental benefits and initiatives such as mobile work centers could help unlocking the transformative power of ICT for environmental benefits.

For medium ICT maturity cities, such as Delhi and Sao Paulo, connecting entrepreneurial businesses and citizens in these rapidly growing economies can both further citizens' benefits and help maintain economic growth by improving citizen health, education and productivity whilst lessening the adverse impact on the environment from the rapidly expanding economic activity. Transformation from physical into digital services and experiences like we have seen in the media industry, reduced need of transportation and traveling with smarter telemeeting solutions are some initiatives which illustrate this.

For low ICT maturity cities, such as Dhaka and Manila, the overall conclusion from the previous release still holds in that governments should take an active role to "push" initiatives to improve ICT-literacy in parallel to continued ICT investments. Care should be taken to balance citizen and business needs within the constraints of the environment. For example, the substitution from e.g. bicycling to more private motorized transportation as income rises may be averted by leveraging ICT to improve city public transportation as well substitute transportation needs with telecommuting and teleworking.
World financial centers should use ICT to carry economic benefits into the social and environmental dimensions

In the Citizen’s Index, New York, Los Angeles, Tokyo and Paris are characterized by relatively high ICT maturity and triple bottom line leverage. These cities score high in especially the economic dimension, being world financial centers. Here citizens enjoy unmatched employment and entrepreneurial opportunities in everything from finance to fashion. At the same time, indicators such as the GINI coefficient need to be carefully observed to avoid large imbalances in income distribution and the social tensions this may cause. Paris, being overall more evenly distributed in income gains an edge from the citizen’s perspective in terms of wage expectations and relative income levels, yet could improve its entrepreneurial conditions compared to peers.

These cities also provide a wealth of social opportunities for entertainment and belonging not least, however the wealth of traditional forms of entertainment, such as opera, concerts and sports events could potentially play a role in explaining their relatively lower adoption of digital services compared to top cities.

For example, the city of New York uses ICT to improve social and environmental aspect of citizen’s life in the metropolitan area:

- The Metropolitan Transit Authority launched wireless and mobile phone network services in 6 first stations in New York subway system. 277 underground stations will be equipped with wireless service by 2016. AT&T and T-Mobile are the first carriers to operate the network

- AT&T will offer free Wi-Fi hot spots in 20 New York City public parks in support of a new digital road map for the metropolitan area

- The government of NY initiated a $1 billion stimulus package in 2009 to develop the use secure, efficient, and reliable Smart Grid technologies

- The Metropolitan Department of Transport introduced the PARK smart program, a scheme with smart parking prices evolving according to the demand for parking space, and thus encouraging motorist to park no longer than necessary
Several BRIC cities such as Sao Paulo and Delhi show promising initiatives for rapidly closing the socioeconomic gap through multi-stakeholder ICT engagements

In the Citizens’ Index Sao Paulo is represented in the middle segment of the matrix, but with a comparably higher ICT leverage than other cities with similar ICT maturity (e.g. Mumbai and Delhi). Sao Paulo has previously been awarded several national and international awards for e-inclusion programs. The prioritization of these highlight an awareness of the need for improving ICT literacy and the key role that ICT literacy has in enabling further development and leverage of more advanced ICT services.

Sao Paulo also has ongoing efforts with using ICT to improve efficiency in public administration. A new function “Coordenadoria de Governo Eletrônico e Gestão da Informação” (E-government) has been established to identify, spread and support implementation of successful models and ICT-concepts within the city of Sao Paulo. An interesting municipally initiated concept is the Electronic Invoice (NF-e) document aiming at replacing traditional invoices. The NF-e is a document issued and stored via a system hosted by the Municipality of São Paulo. Use of the NF-e document allows the user to benefit from services connected to tax registration, autocomplete data policy services and more. Besides improved efficiency and management control for the user, the receiver can benefit from up to 50% reduction of property tax when using the system.

Other interesting e-solutions provided by the city is the Electronic Licensing System helping to reduce the complexity to set up a business. All together ICT clearly helps and holds large potential for improved economic and governmental efficiency in Sao Paulo.

In Delhi there are several promising ongoing initiatives to leverage ICT for the betterment of the citizens. Economic benefits are derived by such projects as Eko. Eko enables small value financial transactions using mobile medium and access through retail outlets. Functions are also adapted and no more complicated than necessary, for example, transactions are enabled by initiating a missed call. This excellent example is a multi-stakeholder project where three of India’s largest organizations, AirTel, State Bank of India and ICICI are all engaged. In 2010, more than 50,000 customers who didn’t have any banking relationship previously were using Eko services actively, and transactions worth 5 million INR were conducted every day. In a city such as Delhi, potentially thousands of citizens can gain the basic financial services needed to more effectively and safely start entrepreneurial activities and receive payments for work.

Since 2008, the government of Delhi is implementing the Jeevan project to enable citizens to get a better access to a large range of B2B, B2C and public services. The government is currently introducing 8000 kiosks across the city to provide citizens with easier access to basic government and private services. The scheme has been prepared by the IT department of the city and is operated by a private partner. Each kiosk is a computerized service center acting as a one-stop shop to offer citizens:

- **Public services:** A total of 103 services from 23 different departments such as water bill payment, school application, caste certificates, birth certificates, railway tickets or driving license renewal
- **B2C services:** Movie tickets, filing of tax in Axis Bank, recharge of prepaid cell phone
- **B2B services:** financial services, promotion
Education is a prerequisite for efficient leverage of ICT

In the previous part of the index, investigating the city perspective, it was concluded that citizens and workforce ICT literacy was a key enabler for city benefits from ICT. This is also true from the citizen's perspective, and is relevant for cities across the ICT maturity index.

The highly successful implementation of home-PC initiatives employed in London and Stockholm should be seen as good initiative examples for empowering citizens' ICT literacy, and is highly relevant for medium-ICT maturity cities such as Sao Paulo and Buenos Aires.

Manila is one of the cities identified in the lower range of the ICT development scale. Manila is also the world's most SMS-texting city, presenting a similar pattern to many African cities due to high mobile phone usage and comparatively lower computer penetration. However, Manila is well ahead of African cities such as Johannesburg and Lagos on the ICT development curve. Securing ICT knowledge among the future workforce is essential to realize the vision of being a hub for business process outsourcing, voice services and software development.

Capability development in Manila is supported by both public and private initiatives, one of them being the public I-school learning initiative, having equipped 4500 public schools with an I-school learning center and training for appropriate usage. A learning center includes internet ready computers, a printer and air conditioning. Workshops in combination with monitoring and evaluation of the usage are made to support the usage of the centers.

Several other initiatives support ICT skills development in high schools, higher education and industry sectors. In the science and R&D sector, the e-Science Grid Program focuses on creating a grid infrastructure for a collaborative environment between research institutions. The grid enables, among other things, high performance tasks to be undertaken by partner institutions and researches (e.g. numerical modeling).
8. CONCLUSIONS AND NEXT STEPS

The Citizen’s Index is the second part of the Networked Society City Index series. The city perspective was the first part and the “Life of business” is yet to come. The Networked Society City Index is a tool that can help city authorities and decision makers monitor the position and progress of cities along the ICT development curve. It should be read as the starting point in an open dialogue rather than the final word on how cities can progress their triple bottom lines.

In this analysis, we have seen that some cities more than others manage to leverage ICT investments to realize social, economic and environmental benefits for its citizens. The challenge for the leaders will be to maintain their position and continue to work intelligently with ICT to generate further benefits and prosperity. The challenge for others is to learn and get inspiration from the leaders to develop into true networked city societies.

Ericsson invites city level authorities, citizen representatives and others to engage in discussions on how to best use ICT investments to serve the city, its citizens and its businesses. Hopefully this initiative can serve as one humble inspiration point for one of mankind’s greatest challenges today namely the continued journey towards the Networked Society.
9. APPENDIX: LIFE OF CITIZENS INDEX METHODOLOGY

9.1 SELECTION OF CITIES

Cities included in the Citizen's Index are based on the United Nations list of largest cities with the addition of the capitals in the two leading nations in the Networked Readiness Index, published by the World Economic Forum. The addition is made with the purpose to ensure that cities with a strong ICT development are captured in the study.

Few adjustments have been made to the above mentioned in order to ensure a list of cities with geographical spread across the world. The rule of maximum one city per country has been applied for all countries, except for the three most populated countries in the world; China, India and the United States. For these countries, two cities have been accepted. Also in accordance with the aspiration to ensure geographical spread of the study, two cities have been added; Sydney and Johannesburg.

Some cities have been excluded from the list due to lack of data availability (Kinshasa, Lima).

9.2 PROXY SELECTION

As discussed above, direct relationships in socioeconomic science are hard to prove, and one might question how an index could measure the triple bottom line effects of ICT. There are multiple ways of building an index, and an index can never claim to fully capture the complexities of a society. An index uses proxies for what it aims to measure. For example if we aim to describe what happens in economic development as a city uses ICT, a basket of indicators such as GDP growth and job creation may be used as proxies for economic development.

If we as a criterion for proxy inclusion say that the relationship needs to be completely proven, we will end up with an empty index as no relationships between ICT development and triple bottom line effects have been fully proven (a situation characteristic for social sciences). If we widen the criterion for proxy inclusion somewhat to include proxies where the overwhelming body of global evidence points to (but does not fully prove), we will end up with less than a handful of proxies with which to measure all triple bottom line effects. Yet again we are short of what is needed for a full index. Only if we take as a criterion for proxy inclusion factors where a cause and effect relationship is logical and reasonable but neither fully nor near proven we will end up with enough proxies needed to build an index.
9.3 INDEX METHODOLOGY

It is an ongoing effort by the research community to provide the full picture on the impact of ICT. Although an index can claim neither to fully capture the complexities of a society, nor to isolate causal impacts, it is an effective tool for comparing the performance of cities on a multitude of dimensions and indicators. Technically, indices employ proxies and indicators for what it aims to measure and thereby rely on the quality and validity of these. For example, if we aim to describe economic development as a city uses ICT, a basket of indicators such as GDP/capita growth and job creation may be used as proxies for economic development.

If a strict criterion of linkages being proven and undisputed, we will end up with an empty index as no relationships between ICT development and triple bottom line effects have been proven beyond all reasonable doubt. This is especially true for the environmental dimension where data on the full societal impact of ICT is just beginning to emerge and where life-cycle methods for measuring are preferred. Instead, a more pragmatic stance must be taken, including factors where a cause and effect relationship is logical and reasonable however perhaps not fully proven.

In terms of weighting two different approaches can be taken. The first one is differentiated proxy weighting. This index construction choice is preferable if a means exists to base the index weighting on a relatively speaking unbiased and uncontroversial weighting mechanism. If no such unbiased and uncontroversial weighting mechanism can be found an equal weighting index construction may be preferred. Such a construction may with few proxies over or under estimate the importance of a specific variable. However as the index is populated with more proxies, the total mass of equally weighted proxies will gravitate towards the entity it is designed to reflect. For the citizen’s perspective a number of key categories were created to assure a multifaceted index to more aptly capture e.g. the different aspects of social benefits.

The Life of Citizen Index is a framework designed to describe the development status of cities worldwide in terms of ICT maturity and triple bottom line effects derived from ICT (figure 4) from a citizen’s perspective. This is measured on two principal axes.

The horizontal axis is a measure of cities’ ICT maturity and the vertical axis illustrates the corresponding triple bottom line leverage from ICT investments.

ICT maturity dimension is determined by availability and performance of ICT infrastructure, the cost at which the services are provided and the actual usage levels. The logic and design is similar to the Networked Readiness Index annually published by the World Economic Forum at a country level, however with a more direct focus on measurable ICT maturity and less on prerequisite components. In total 14 indicators are used to capture the maturity dimension. ICT maturity is evaluated in three main dimensions (ICT infrastructure, ICT readiness and ICT usage). Key indicators within each of these dimensions are given equal weighting to form a measure of general ICT maturity at city level. The ICT maturity index does not reflect the same amount of indicators as the NRI, mainly due to data availability.

The ICT derived triple bottom line benefit on a citizen level is determined by social, economic and environmental benefits. For the social dimension, the categories were inspired by Maslow’s hierarchy of needs. Whilst this model is one of many models available from the field of psychology, it is one which has prevailed over time and is commonly recognized and used in several fields including management theory, behavioral economics, etc. This is used as a guiding principle for identifying categories, whilst aspect of the exact order and operation of the need hierarchy levels is not used.
The categories specified for the social dimension included basic human needs as well as more advanced needs for self-fulfillment:

› **Health care quality**

› **Security**

› **Entertainment & belonging**

› **Self-fulfillment and happiness**

ICT can enable e-health services, as well as security services both, digital and physical, to improve law enforcement performance. Entertainment and belonging is also a key need for citizens. ICT provides on-demand entertainment by music, video and gaming as well as outstanding opportunities for social interaction through e.g. Facebook or Skype.

For the economic dimension, four key aspects were identified based on economic theory:

› **Income level**

› **Income distribution**

› **Employment opportunities**

› **Entrepreneurial opportunities**

Income level and distribution reflect citizens’ expected economic benefits from being employed in the city. The employment opportunities and entrepreneurial opportunities categories reflect the conditions for finding or creating an income source. These four aspects work together to provide the foundations of economic prosperity for citizens, and it is important for cities to mind all these aspects in order to attract the best employees and entrepreneurs at all levels.

ICT can contribute directly by creating new jobs for investments, indirectly through e.g. improving productivity and also give rise to an induced effect from new businesses and industries created in combination with innovative entrepreneurs.
Figure 3.
Economic impact of broadband investments
(Arthur D. Little analysis)

ECONOMIC IMPACTS OF ICT INVESTMENTS

- Short term boost in economic output generated by the direct expenditure of the investment
- Medium term effects which occur due to increases in productivity
- Long term structural changes in the economy (new businesses etc.)
In the environmental dimension, three key categories were selected which focus on the transformative potential of ICT to reduce the mainly CO2 aspects of environmental intensity of human social and economic activity otherwise associated with e.g. increased economic output. In the citizen index we have for the environmental dimension focused on ICT enabled progress capturing primarily CO2 emissions for transportation. This is an area where ICT based services and applications are available and where data is available making statistical analysis possible. Furthermore within transportation citizen attitudes, habits and behaviors are stronger drivers compared to individual influence over the effects from areas such as power generation, buildings and industrial processes:

› **Use of public transportation, biking and walking**

› **Dematerialization by digital services**

› **Telecommuting**

Firstly, the usage of less emission intensive transportation means, such as bicycling and public transportation can be made more attractive by ICT initiatives. For example by providing WiFi on public transportation, citizens can actually improve their efficiency and save time by working whilst commuting. Also, ICT powered solutions, such as the “Near-by-station” feature used by Stockholm City Bikes, enables citizens to conveniently locate the nearest bicycle pool with an available bike and thus improve the attractiveness of using bike as an alternative means of transportation. Using ICT to lower the opportunity cost of less emission intensive transportation is a means to create a utility basis citizens to substitute.

Secondly, ICT enables dematerialization of physical services by substituting to digital services. These can be similar to the services which also yield social benefits by moving that consumption for the purpose of e.g. entertainment into a digital realm, eliminating the environmental impact from transportation, production, manufacturing and use of resources.

A more extensive means to reduce the environmental impact of citizens' economic and social activities is through teleworking (telecommuting). In addition this would reduce the land use by reducing need for office space. Government policies, such as the Telework Enhancement Act of 2010 in the United States, in combination with sufficient maturity of ICT infrastructure may have a powerful effect; American cities are in the world top from the perspective of teleworking.
The Citizens’ Index provides a map of 25 world cities and their positions along the development path towards the Sustainable Networked Society. The comparative positions and the development path of other cities can be used as a compass to guide individual efforts by city planners and other stakeholders with an interest in triple bottom line gains.

A position above the trend line would indicate that the city is highly focused on leveraging from ICT investments made, however cities placed far to the left could probably gain additional benefits from increasing their ICT investments.

Correspondingly, a position below the trend line would indicate that the city is more focused on developing the ICT infrastructure as such, and should as a next step focus on leveraging from investments made.

It should be noted that the cause and effect relationships may be both mutual and multiple (x influences y, y influences x, and both variables may both influence and be influenced by z.) as previously illustrated in figure 3.

**Figure 4.**
The Citizens’ Index; the horizontal axis represents the ICT maturity in the cities and the vertical axis represents the triple bottom line leverage from ICT.
<table>
<thead>
<tr>
<th>CITY</th>
<th>INITIATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAIRO</td>
<td>Egypt has initiated several e-health initiatives where Cairo and it’s major hospitals are in the center of development (e.g. hospital automation, reduction of emergency response rates)</td>
</tr>
<tr>
<td>DEHLI</td>
<td>Dehli’s is pursuing a rationalization process (“Mission convergence Programme”) aiming at converging Delhi’s nine social welfare departments efforts to provide targeted social welfare to poor communities with ICT enabled solutions</td>
</tr>
<tr>
<td>DHAKA</td>
<td>Jakarta develops nation wide e-government services to ease for citizen to access services and to improve transparency in services provided (e.g. the e-purjee system allowing sugar cane growers to get issued permits through SMS)</td>
</tr>
<tr>
<td>ISTANBUL</td>
<td>Digitalization and automation of health care services are in focus in Istanbul (e.g. digitalization programs for home care, disability care and women’s health)</td>
</tr>
<tr>
<td>JOHANNESBURG</td>
<td>An ICT center in Johannesburg strives to help growth of local ICT companies though education, business incubators and more – black economic empowerment is in focus through it’s incubator strategy</td>
</tr>
<tr>
<td>LAGOS</td>
<td>Paradigm Initiative Nigeria (PIN) drives socioeconomic development through youth training in information technology and entrepreneurship skills in the slum areas of Lagos (government supported)</td>
</tr>
<tr>
<td>MANILA</td>
<td>“I-school learning centers” and other government initiatives help filipinos gain an appropriate ICT-education and ensures that the work force gains the necessary skills for a technology oriented job market</td>
</tr>
<tr>
<td>NEW YORK</td>
<td>New York City actively uses ICT to reduce the inequalities in the big Apple – the “Online Home Learning” initiative for low income families will benefit 18 500 sixth grade students</td>
</tr>
<tr>
<td>PARIS</td>
<td>Public transparency, e-democracy and citizen involvement are strong trends within Paris (e.g. open data initiative providing access to municipal datasets, e-democracy applications and high tech urban innovation initiative via collaboration with Paris innovation labs)</td>
</tr>
<tr>
<td>SEOUL</td>
<td>Seoul is ranked as number one in the global survey E-government in municipalities (Rutgers, the State University of New Jersey) – a main differentiator is the way the city invites its citizens to play an active role in governmental processes</td>
</tr>
<tr>
<td>SÃO PAULO</td>
<td>Public telecenters are today widely spread in São Paulo – 350 centers with 5 million registered users exist aiming to improve digital inclusion</td>
</tr>
<tr>
<td>SÃO PAULO</td>
<td>São Paulo’s Young Tech initiative aims to educate pupils (16-21 years) in public high schools in ICT – the purpose is to empower young people in the area of ICT and ensure that they enter the job market with the appropriate skills</td>
</tr>
<tr>
<td>SÃO PAULO</td>
<td>The city of São Paulo hosts a solution for electronic invoices to improve administrative efficiency</td>
</tr>
<tr>
<td>SÃO PAULO</td>
<td>The city of São Paulo promotes public transparency. Initiatives such as an interactive statistics portal and the website aiming to openly display all municipal expenses supports the development</td>
</tr>
<tr>
<td>SINGAPORE</td>
<td>Singapore is a strong innovative force within e-health development – the project for National Electronic Health Records is one of several initiatives</td>
</tr>
<tr>
<td>STOCKHOLM</td>
<td>The website stockholm.se is being transferred into a service hub, adopted to help citizens use, benefit and contribute to the political system based on freedom of choice for schools, elderly care and more</td>
</tr>
<tr>
<td>BEIJING</td>
<td>Beijing municipal government has announced a new e-commerce zone to further strengthen Beijing’s already strong position in the e-commerce industry</td>
</tr>
<tr>
<td>BUENOS AIRES</td>
<td>A public-private partnership in the province of Buenos Aires gives 450 000 civil servants access to the skills and tools needed to use ICT and promote e-government solutions</td>
</tr>
<tr>
<td>JAKARTA</td>
<td>The “National Single Window” initiative in Indonesia helps simplify import and export procedures by allowing traders to submit one single document and to receive one single approval</td>
</tr>
<tr>
<td>JOHANNESBURG</td>
<td>The Johannesburg 2030 vision aims at improving the quality of life and economic growth – ICT is an important component to achieve this (e.g. adopt skill level, establish reliable systems for private and public sector, improve telecom infrastructure and mobility)</td>
</tr>
<tr>
<td>LAGOS</td>
<td>Information systems in Lagos and Nigeria are used for land and property registrations as well as for tax collection – the digitalization helps limit public waste</td>
</tr>
<tr>
<td>LONDON</td>
<td>London Datastore provides open access to previously unpublished public sector information – improved services, reduced costs of services and business opportunities for SMEs are seen benefits directly derived from the publication of data</td>
</tr>
<tr>
<td>LOS ANGELES</td>
<td>E-government and on-line services are being pushed forward in Los Angeles to improve efficiency (e.g. mobile applications, internet self services, online tenders and e-government applications)</td>
</tr>
<tr>
<td>MANILA</td>
<td>The Philippines have a strong focus on job creation based on ICT development on a national lever – the cyberservices corridor projects is a important initiative to enhance job growth</td>
</tr>
<tr>
<td>NEW YORK</td>
<td>Innovation and technology development are promoted through the New York BigApps 2.0 Competition</td>
</tr>
<tr>
<td>SINGAPORE</td>
<td>In 2008 Singapore’s InfoComm Development Authority established a holistic strategy to attract foreign investment and sustain long-term GDP growth through the ICT industry, called the iN2015 plan</td>
</tr>
<tr>
<td>SYDNEY</td>
<td>Australian Centre for Broadband Innovation will be launched in Sydney in 2011 to capitalize on the national broadband network</td>
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</tbody>
</table>

**Figure 5:**
ICT driven initiatives in worldwide cities.

*Continues on the next page*
<table>
<thead>
<tr>
<th>CITY</th>
<th>INITIATIVE</th>
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<tbody>
<tr>
<td>LONDON</td>
<td>ICT is an integrated part of London smart systems approach for its traffic management, which has lowered the traffic volume to the mid 80s.</td>
</tr>
<tr>
<td>LOS ANGELES</td>
<td>The first phase of Los Angeles city wide smart grid initiative is currently being rolled out — large industries and pilot home owners will benefit from the project in a first stage.</td>
</tr>
<tr>
<td>MOSCOW</td>
<td>Moscow transportation department are suggesting congestion charging for personal cars as part of the solution to Moscow’s traffic congestion.</td>
</tr>
<tr>
<td>PARIS</td>
<td>Paris will soon host the first major government initiative in car sharing — 3000 electric vehicles are expected to operate through the “Autolib” program.</td>
</tr>
<tr>
<td>SÃO PAULO</td>
<td>The city of São Paulo monitors the biological health of the trees with a new software developed to manage the target of planting more trees in the city.</td>
</tr>
<tr>
<td>SHANGHAI</td>
<td>A Shanghai Smart Grid project uses advanced information technology to reduce blackouts and use powers more efficiently and environmentally friendly.</td>
</tr>
<tr>
<td>SINGAPORE</td>
<td>Singapore installed the world’s first digital congestion charging scheme in 1998.</td>
</tr>
<tr>
<td>STOCKHOLM</td>
<td>The Stockholm congestion charging scheme was introduced in 2006.</td>
</tr>
<tr>
<td></td>
<td>Stockholm is building Smart City areas where ICT is a major engine for green development (e.g. Royal Seaport project, including trials on smart grids)</td>
</tr>
<tr>
<td></td>
<td>A high school is completely heated 6 months a year from excessive heat from an underground server room.</td>
</tr>
<tr>
<td>SYDNEY</td>
<td>Sydney promotes public transport with modern solutions (e.g. WiFi access at metro busses and at ferries.</td>
</tr>
</tbody>
</table>

**SOURCES**

Arrow et. al. (1995),
Climate Group and GeSI (2008)

Based on a comprehensive literature review conducted by Ericsson and Arthur D. Little covering 120 academic studies and business reports.

Based on comprehensive econometric calculations conducted by Ericsson, Arthur D. Little and Chalmers University of Technology.

Stockholm Challenge, 2010
(http://www.stockholmchallenge.org/project/2010/eko)

Ericsson white paper, C40 report.

The NRI pillar “Environment” has been renamed to “ICT infrastructure” in the ICT maturity Index to better reflect the selection of indicators.