IT Development in the Local Setting

an Architectural Perspective

Stig Gustavsson & Ulf Keijer

The objective of this article is to describe some relevant undertakings related to the introduction of local communication networks in residential areas in Sweden and to broaden the discussion on the ongoing IT development and its influence on local settings and living. A further objective is to discuss how current and expected changes might influence research in architecture and its relevance for the architectural profession.

A source of change in contemporary society is the current sweeping development of information technology, IT. (IT is used in this article as a common concept for the totality of information and communication technologies.) This technology embraces all facets of life, thus also our homes and the local environment, as well as their use and the very living at home. Thereby it becomes a prime issue for architecture as a profession and consequently for the development of knowledge in architecture – and for architectural research. The approach of the research presented in this article originates also from the global changes currently taking place with profound impact also on local levels. A prime consideration is that the conditions of production as well as of consumption are influenced.

To illustrate the ongoing changes some development projects in local settings will be presented. As will be seen, municipally owned housing companies will often have a key role. Municipally owned housing companies in Sweden have housing stocks allocated rather densely implying favourable conditions when introducing an IT infrastructure. Further, the owners are often affirmative to a development of a town net in order to tie their housing units and inhabitants closer to themselves by supporting measures for public service and local business. Although the presented projects are by no means conceptually unique – similar projects are tried in other places with diverse outcomes – they will add concretion to other more abstract parts of the presentation.

A specific project, IT-BO, which started in the early 1990s, was designed to provide knowledge and to set out the pace about a future development of IT in a local housing area. Vällingby was chosen for the undertaking, developed during the 1950s, at that time a typical "new town" establishment situated outside the Stockholm City centre. Many foci for

such an unexplored domain for development could be envisaged. Our interest, however, from the very beginning, was directed towards service provision through IT in a local context, Keijer&Hunhammar (1995), Keijer&Nilsson (1996). A so-called *ideal model* for service delivery was developed; firstly to ensure a complete delivery chain from a variety of service providers to the tenant-customer; secondly to provide a means for maintaining competition between these providers and to open up for new entrants.

Interviews have been conducted with representatives of local service providers. The principal issue most of them asked for was a good showcase on how to use the new IT-supported infrastructure for their own business. Projects directly aimed at this purpose were initiated at several places, of which some will be mentioned below. A survey of the driving forces having impact upon local governments and housing companies for establishing IT infrastructures was conducted, too. The survey was carried out about a year ago among all municipally owned housing companies. It will be supplemented with additional personal interviews with some representatives of the more active housing companies about the recent IT development and how this affects their current planning.

These topics mentioned will be described a little more in depth in the following. The aim is to broaden the discussion further about the ongoing IT development and its influence on local settings and living. Further, an objective is also to discuss how ongoing and expected changes might influence research in architecture and the architectural profession as such.

Consumer power and infrastructure – the "ideal" model

The background

Svenska Bostäder is one of Sweden's largest housing enterprises with some 50.000 flats, of which 10.000 in Vällingby. The project started in a multi-storey building with some 45 flats. The Architectural School at KTH took part in this early stage of the project, from 1993 and on, in the beginning as contributor to the conceptual developments, Hunhammar (1998), later as evaluator, Junestrand&Keijer (2000). The project was called "IT-BO"[1].

The initial visions of the project aimed at establishing a so-called*intelligent building*, Lustig (ed., 1995). Very soon, however, the project refocused and the key objective became "services and communications to the tenants", i.e. service delivery. The project has developed further and today the intention is to provide the whole Vällingby area with a fibre-based *area network* connecting all buildings in Vällingby. Each building will have its own *in-house network*.

The first installations were completed in 1996/97 in the "test bed" building. The installations included access and safety appliances for the building and its common spaces. An electronic information device (flat screen) was installed in the entrance hall for communication with the housing service centre. Later, training was offered to the tenants and flat terminals were made available and installed in some flats. Some of the tenants have their own computers connected to the broadband network now in operation.

Several series of interviews were carried out with the residents of the building mentioned and in a neighbouring building in 1995, 1997, and 1998, see Östlund (1995) and Junestrand (1998). The buildings contain small flats, mostly just one or two rooms with kitchen and bath. They were inhabited by small households, in general consisting of one or two persons; half of them were 65 years old or older.

In 1999 several terminals were installed in flats in the "test bed" building, now adjusted to the new technology. Discussions were going on about what services to be offered. Telephone service to the flats was considered, partly because income from telephony was considered a way to contribute to the financing of the investment of the network infrastructure. The budget for the development was rather tight and much more was desired than was possible to realise.

In addition to the tenants, especially those residing in the "test bed" building, the participants of the project were Svenska Bostäder (project owner, local consumer operator and service operator), Ericsson Telecom (provider of infrastructure), City council social services in Vällingby (potential service provider), the County of Stockholm Labour Market Agency (service provider), SABO[2], KTH architecture (coordination, monitoring and evaluation) and – in a late phase – the Tenants' National Association.

The project has developed further according to the Document of strategy adopted by Svenska Bostäder 2000. The strategy included plans for the expansion of the IT network to more buildings connecting more homes. The proposed network was to be independent of any specific service operator allowing access to any provider with its specific service.

About 4500 homes and about 500 other premises were to be connected. The work started in December 2001 and will be completed during 2002. The IT-BO project, started 1993, was now integrated as a unit into the ordinary organisation scheme of Svenska Bostäder.

The undertakings were preceded by a market survey in the beginning of 2001 in order to estimate the interest for IT to the homes. Unsurprisingly, it was found that access to computers in the home is dependent of the tenants' age. Few older people – and they are plenty in Vällingby – had computer experience, which reduces the possibility to offer services targeted for this group. A collaborative project together with a so-called "senior net" has been set up in order to train senior citizens; this project has been widely appreciated. As a side effect, the social networking between older people seems to strengthen in the area.

Design theory as a theoretical framework

The theory of design will bridge the gap between theory and practice in experimental forms, Lundequist (1995). Here abduction (something is possible) is emphasised as a particular way of thinking closely linked to the process of design, in contrast to a scientific process where the dominating methods are induction and deduction. A design approach in a scientific context has some characteristics, of which future-orientation and action are the most salient. Simon (1981) designed a program for the sciences of artefacts with relevance for professions involved in design of both tangible and abstract products. He viewed design as the art of constructing and using models as a means for decision-making, "understanding by simulating".

Dahlbom (1993) develops ideas around the sciences of artefacts (man-made things) as a pro-active method of research. Dahlbom writes:

> To devote yourself to the sciences of artefacts is to try to give an active contribution to the design of the future, and to contribute to the development of new artefacts and new ways to use them[3].

The IT-BO project exhibits markedly the principal characteristics of a research project to be studied from a design theory perspective. It is clearly action-oriented towards change. It is future-oriented and exhibits a multitude of degrees of freedom. It does not try to explain *how things are* (the governing principle of classical sciences), rather *how things ought to be*, Simon (ibid.).

Schön (1983) enlightens a theory of the very process of design, "reflection-in-action". From a scientific point of view, however, a question remains about generality. It should be eligible that the achieved results are relevant beyond the "unique case". Future-orientation and change, however, will always be related to the intentions of an individual or a group of individuals, see further Gustavsson & Keijer (1999), Nordenstam (2001).

The ideal model

The work within the IT-BO model has followed an early developed scheme for a successive establishment of roles in a business model, however, along a windy path and not without problems over time, Keijer & Nilsson (1996), Hunhammar (1998). These roles are to be fulfilled and performed by different actors. The model is generic, i.e. it should be seen as an *ideal model,* to be implemented differently in different settings. However, the model aims at identifying traditional market structures and at dismantling value added chains not serving the consumers properly in view of the new opportunities offered by the IT technology.

A precondition assumed is that these viable business structures should have a strong foothold in the local society, and that the proposed services are desired and useful for people living in these communities. This precondition is to be identified in the research work and judged if fulfilled in the specific established test sites. Other requirements imply changes concerning organisations and people's tasks and competences. Also from a traditional architectural point of view, the requirement on physical spaces and their relationships has to be taken into consideration.

To start up a development area like Vällingby required both a changed structure of the required roles, i.e. an altered value-adding chain, and new actors willing to perform the emerging new roles, Keijer & Nilsson (1996). A key role has been identified, *the local consumer operator*, LCO, acting as an agent for the individual tenant in his or her relationship with a variety of service providers. A specific LCO was engaged for the Vällingby development in 2001. Thus, it took about eight years to implement practically the initial idea of a changed business structure, in principal as it was conceived from the very beginning.

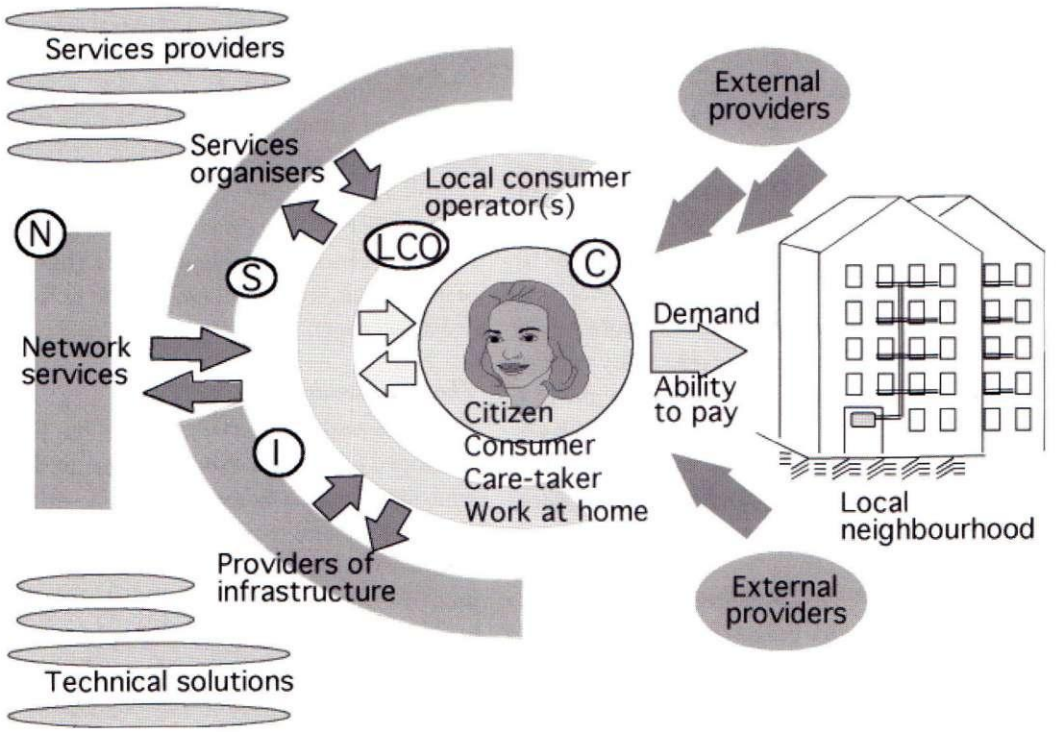

Figure 1. The "ideal model" for IT-supported service infrastructures. The picture illustrates the tension between an ordered structure with a LCO (the ideal model) (left), and a "free" structure (right) in which external operators try to reach the consumer in his/her dwelling, in order to control ultimately also the content of the service.

The supply of services in the telecom sector traditionally has a rigid organisational structure and still exhibits many features generally found in monopolistically organised markets. Strong commercial forces strive to limit flexibility and hamper a free market of service delivery. The problem with cable TV services is well known and is an illustrating negative example. A predefined set of TV channels is generally offered and choices are restricted. A similar development is likely to occur for the internet services and all possible direct services based on internet. Restricting rules for access, design of provider-oriented portals or non-standard technology for the construction of the infrastructure are means for restraining competition to the disadvantage of the consumers.

However, this can still be counteracted if one fully realises the opportunities the technology really offers, and powerful agents, interested in the benefit of people as citizens, tenants, caretakers and ordinary consumers in local environments. It is, however, not an easy task, as the traditional actors, although aware of these new requirements, too often fall back on their traditional ways to behave, especially when unexpected or disordering behaviour is disclosed by other actors in the play.

Figure 1 is a pictorial representation of the ideal business model for IT-supported service delivery in local environments. An interesting feature of the model worth noticing is that the providers of network services, (N) do not have direct access to the end customer (C). The above-mentioned agent, LCO, acts as an interface. This agent should act on behalf of the tenants with their different interests and capabilities in their daily life. The LCO negotiates with all involved parties, i.e. network providers as well as services operators (S), and hardware and systems providers (I) in order to get the best results for their residents, and to preserve competition amongst the parties involved. In general, a housing com-

pany has to take a key responsibility for the establishment of the LCO, however, not necessarily by accepting its role and performing its tasks.

A crucial point in this discussion is that the development of the organisation, the market and the technology cannot be developed separately. This mutual interdependence has been discussed by Keijer (1995) and Keijer & Nilsson (1996). This is a major obstacle for an organic transition from a business structure containing monopolistic elements to a desired structure with many service providers competing to win the consumer's boon.

Further, the model is generic. This means that the different roles can be fulfilled in different ways and in different local settings. A particularly active performer may start by engaging in several roles and later transfer one or more of them to new independent bodies.

For the time being we leave aside the comprehensive issue concerning the possible development of the smart home in the IT society which, at least partly, is closely linked to service provision to the home. Wahlström (1996), Molin & Fransson (1997) describe the dwelling as an arena for a variety of activities supported by an IT infrastructure. Junestrand (1998) refers to a predominating process-oriented perspective. Instead, we will discuss the preparedness of the housing companies in Sweden to accept and fulfil important roles in connection with the development of IT networks, especially broadband networks, now under way.

Good examples as a means for acquiring a driving momentum

To investigate how a number of service providers regard themselves as potential users of a future IT network in Vällingby, a preliminary study was undertaken within the framework of IT-BO, Gustafsson & Keijer (1999). When interviewed, many respondents stated that they lacked knowledge about how to utilise a new IT-based infrastructure for the benefit of their business for getting in contact with the inhabitants of Vällingby. In short they lacked good case studies from their own line of business. In the following some typical examples of such case studies, in which we have been involved, are reported and commented upon.

A large market hall in Trelleborg in south Sweden started recently an internet shopping service for its customers. Orders are placed via internet. Goods are collected and delivered to the individual customer. This new kind of service already has shown to be attractive to a significant group of customers and seems to develop successfully, so far. Immediately, however, it became obvious that a profound reorganisation of the delivery system was required, in order to make the service efficient and attractive for the customers.

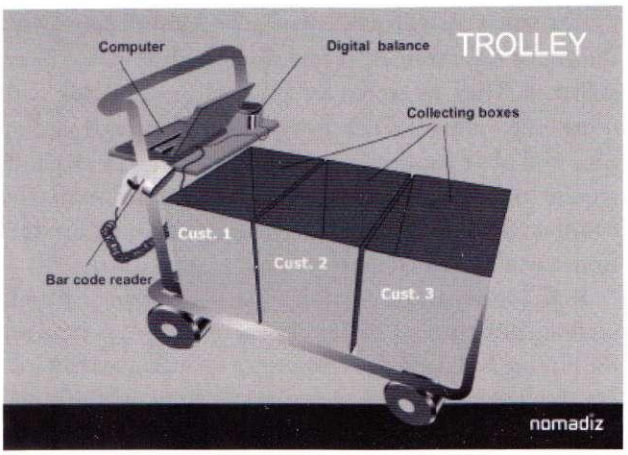

Figure 2. Pick-trolley for three customers (Design by Nomadiz, Malmö, Sweden).

A first step of the regular business often is the weekly web advertisement to connected customers. The offerings include discounts and features of different kinds, e.g. menu suggestions or the dietician's counselling. Specific offerings may be directed to certain groups of customers, so called profiling. A customer placing her order via internet then starts an activity chain.

The customers' orders are transmitted to the computer system of the market hall. The compiling and packaging of the ordered goods is done manually from the shelves of the market hall. The computer organises the lists of goods to minimise the way through the hall. To economise the compiling several customers are served at the same time. Figure 2 illustrates a prototype of a pick-trolley now tested in the market hall. The integrated computer system should be able to propose replacement of goods out of stock with similar items, if possible dependent on the individual customer's choice. Some kinds of goods, like fruit, vegetables, fresh meat, etc., have to be weighted and priced for each item in order to produce the final bill of each order. Passing through the ordinary cash point, checking the items once again should be avoided in order to gain full efficiency.

The orders are related to several other logistic issues. Often the goods cannot be delivered directly after having been collected. They are stored for later delivery together with other orders in view of the customers' preferences regarding time and place for the deliveries. In addition, some goods require cold storage. Se also Steen & Lindström (2001) who conducted a recent study on buying food using internet from a work-oriented perspective.

In Landskrona, also in south Sweden, a preparatory study is taking place using a trolley like the one above to facilitate the picking and packing of groceries in a smaller market hall. Local collaborators are the housing company and the municipal home service for elderly. The project has several purposes, partly rationalisation of the purchases, partly improving the independence of the persons receiving care.

Another project is taking place in the sparsely populated rural municipality of Tierp, some 150 km north of Stockholm. This project also implies collaboration between the municipal home service for the elderly and the pharmacist located at the municipality centre. The placing of a prescription is done via a cellular telephone with a bar-code-reader technology and transmitted to the pharmacist. The drugs – and other goods are handled likewise – are then delivered to the clients or to centres located close to smaller living areas, reducing time and trouble to pick up specific goods.

These examples, if they turn out positively, could serve as "good show cases" for applications of town networks based on IT technology. However, organising physical delivery and storage of goods and the transport of people are other parts of the task to achieve a complete service, which may be harder to resolve, Steen&Lindström (ibid.); at any rate, it will allow for a lot of novel and innovative thinking.

IT influences the local community and living at home

The IT development in Sweden, and probably in all Nordic countries, complies with an international pattern. Castells (1996) describes a development which has been going on since the 1960's towards an informational[4] society, whose most evident features are:

- *a new culture* offering *true virtuality.* Traditionally, cultures have emerged with people present on the same physical space at the same time. Mutually recognised values have been shaped within a given community. The true virtuality is a social structure called the network society,
- *a new economy* – the informational global economy. A decisive factor is productivity and competition, at the same time allowing for a choice between different business organisations. The ability to innovate and to adjust is of decisive importance for the network business. The ability and necessity to quickly allocate adequate resources and, when needed, to deallocate is a condition for fast development,
- *a new dominating social structure* – the networking society. The dominating functions and processes are structured like a network according to Castells (ibid.). The network is characterised by open dynamic structures which quickly integrates new nodes if these additional nodes share the same codes of communication, i.e. values and objectives.

Further, through a geographic enlargement of markets new prerequisites are created for further division of labour and specialisation in more business domains. Businesses and regions specialise where they see the best comparative advantages and possibilities to develop. An important factor for success is the ability quickly to adapt knowledge into new products and services. These changes contribute to people's relocation from weaker zones for business development to those promising better prospects.

In spite of these major changes taking place the trends seem to be somewhat ambiguous; on one hand we conceive many businesses merging into larger units; on the other hand, many small enterprises, even one-person-micro-enterprises, can compete internationally due to unique competences. The latter opens up possibilities for small local businesses – and even to individual residents with an attractive competence. They can exercise their competence directly from their homes. This becomes obvious when regarding music and entertainment business. This kind of business is based on single individuals and often on teenage groups that are formed occasionally under certain living conditions. We may notice the same kind of initially not very well-defined activities when we try to observe what is going on within the IT sector, e.g. regarding the development of IT based games on the world wide web.

IT in its broadest interpretation has a potential to prolong the period of time elderly people can stay in their ordinary homes. Partly, this becomes possible when specific services via the IT network are offered to older tenants and to the organisations providing different kinds of services for them, e.g. home care providers, groceries, church communities and other voluntary organisations, Gustavsson & Keijer (1999). There are good reasons for people to remain in the home they once moved into, with the condition that the home as such still provides for the household's needs. Good services in the vicinity and good public transport, access to leisure activities, nice neighbours bringing safety and security are important factors. The existence of a supporting social network in the neighbourhood is of decisive importance emphasised by e.g. Birgersson & Armbruster (1994), Putnam (1995), (2000).

New technology may contribute to strengthen social cohesion and to reinforce the functions of local social networks as well, see also Granovetter's (1973), (1982) concepts of "weak ties/strong ties". Granovetter's theory presupposes clusters of common values. The ties between clusters can be weak or strong. Granovetter particularly emphasises the weak ties for the creation of connectivity in a society supporting social cohesion. Weak ties can add new interesting features to a cluster as would be the case with strong ties. Strong ties, however, inherently, also generate forces opposing change, se also Grabher (1994).

We cannot yet see that the development of an infrastructure based on IT causes any profound changes when considering social and cultural visions of a future society. Most evident in Sweden is the concern for a real depopulation of small towns and rural areas; less is written about the positive possibilities of change. To work and to study at distance via a communication network has been mentioned as an opportunity for many, however not yet manifested as a real strong trend, albeit this has potential advantages for many types of households.

Neighbourhood development

Having confidence in IT for creating provisions for the development of one's own region has brought many local authorities to engage in town networks. Wihlborg (2000) describes how local authorities adapt their development of IT infrastructures to local conditions depending on local business structure and current production, population and development power. Local housing and energy companies take part in the shaping of local IT policy documents and the expansion of broadband networks. The strategies differ between different municipalities, very much depending on local prerequisites.

To develop a town network is a large undertaking for many local authorities which makes it tempting to include other actors in order to finance and manage the system. There is an obvious risk that the operator, in exchange for its participation, demands exclusive rights to the network and the services offered with it. If so, it clearly violates the basic ideas behind the *ideal model* and the competition between service providers are in danger.

A driving force for a customer demand for further expansion of IT networks is the dissemination of internet usage among local small businesses and people in general. The results of two surveys undertaken by the Statistics Sweden, SCB, (2000) show that nearly four million persons, among a population of 5.3 million persons in the ages between 16–64 years, about 75 %, have access to a computer. However, differences between different age groups are marked. The large portion of people having access to a computer at home depends on subsidised schemes available for all employees during the last three years, Pettersson (2001). The survey did not include computer users above the age of 65 who supposedly have access to a computer at home to a much lesser extent than other groups, probably, on an average, less than the 18 % computer users found in the IT-BO survey in Vällingby.

Many local authorities and housing companies face a lot of other problems in their business and political undertakings. Increased migration leads to negative population trends in many areas. More than 200 out of 289 local authorities in Sweden report decreasing population and a substantial surplus of empty flats. Empty flats deteriorate the basis for public and commercial services and thereby contribute to further decay. The IT development at large is regarded as a possibility, even a straw to cling to, for many local politians having to put up with a good deal, Wihlborg (2000). For some, where the conditions are favourable, the IT development may turn out to be a critical resource for change. For others, less favourable, the outcome will be shaky.

Housing company survey about broadband connection

At the turn of the year 2000/2001 the Architectural School in co-operation with SABO[5] made a survey to 301 housing companies in Sweden. These companies own and manage some 900.000 flats. Out of these 301 questionnaires 180 (60 %) were returned representing some 727.000 flats (81 %).

The responding companies replied that some 455.000 flats (out of 727.000) were to be provided with broadband connections. By the respondents broadband[6] is generally understood as ADSL (Asymmetric Digital Subscriber Line) which utilise the ordinary telephone lines, upgraded cable TV network, or WAN (Wide Area Network), the latter of which is based on optic fibres. Out of these 455.000 homes 275.000 (60 %) will be connected to broadband at the end of year 2001 according to the respondents.

Many choose ADSL (52 companies out of 180) or upgraded TV networks (69 companies) in order to be able to quickly offer internet and certain additional services. A number of companies offer several alternatives (mostly two) in order to establish some sort of competitive opportunity for their tenants. Some 81 companies have the ambition to offer a service supply independent of the network operators. Fifteen housing companies offer already independence in this respect, according to their own statements. This is to be checked further by telephone interviews.

Some of the companies who have chosen ADSL and cable network will later probably turn to WAN, which is potentially faster, albeit currently more expensive. The responses reveal that most housing companies await general technical development before engaging in any dearer capital investments. In small towns and municipalities in the countryside very little interest is noticed for investing in broadband networks by the nationally operating telecom companies. If anything will happen in this field, all costs have to be carried by the local housing company or by the local municipality, which in most cases will turn out to be too big a burden. Few intentions were expressed aiming at increasing the inhabitants' knowledge of IT and thereby improving their ability to find better jobs on the labour market.

Regarding services the response is meagre beyond the obvious internet service; about ten companies report public information, services for the elderly in their homes, medical/technical services, contacts with service providers and local authorities. A few mention the communication network as a service of its own and its importance for local public services and for local commercial life.

Tenants' attitudes to internet connections in the home are primarily focused on communication via e-mail and internet, like information search, news, and banking services. As the services are adjusted for a broadband net, and as this is not yet available, costs for faster communication increase and therefore many tenants are satisfied with a slower connection to the telephone network. Some housing companies, in particular those in less densely populated areas, also note that there is hardly any interest in broadband net services. Certainly, an aging population support this attitude. Urban areas are different. Interest from the consumers is apparent, however, lack of service of real value hampers the development.

However, this field is developing to a lesser extent than the present public discussion may signal. At any rate, the housing companies in Sweden and their owners, the municipalities seen as entities, are already important actors and will be more so in the future. These companies will play an important role in many places for the establishing of communication networks for their tenants, perhaps even for residents in other parts of the municipality.

Conclusions

Above we have discussed how the development of information technology can be a driving force for changes in local societies. We have also pointed out that the municipalities, generally in co-operation with local housing companies, would be an important driving force for the establishment of new telecom infrastructures enabling services influencing people's life at home and in local settings. This development cannot, however, be taken for granted. Local conditions and ambitions of local leading stakeholders, i.e. politicians, local industry, interest groups, etc. play a big role in this development.

Our study indicates that the IT development influences people in the area, firstly their living environment, and secondly, the built environment. For the architectural practice complex conditions emerge, causing questions that should be addressed by architectural research.

Changes in society seem to proceed so fast that their consequences cannot be assessed by analysing existing technical levels only, and without demanding more of creative and visionary thinking than was required only a few years back. These changes can be encompassed within the aspects of

concept and *project* of architectural research according to Gromark (2000). Within the framework of concept there is room for issues related to meeting places and their importance for the development of social processes as well as to the realisation of premises for different activities. The issues also reflect the *interplay between man/spaces/artefacts*. It is possible to associate these consequences to *cultural projects* having an important impact on both architecture and urban planning. As we see it, it is obvious that the professional architect has to carry a certain responsibility as the mediator of interests, however, often being in conflict with more shortsighted interests by facilities management, financing and technology.

Much of IT related architectural research will rely on the design process, the change of service structure in many local communities, the artefacts and functions in our homes, etc. The physical buildings are very much in place, however, as they require adaptation to new conditions imposed to a large extent by the IT development. As Linn et al. (1998) mention the architectural history and case studies are important methodologies to understand and to explain what currently is under way. Simon (1981) and later Dahlbom (1993), in the same spirit, add the future orientation. By regarding, creating, testing and analysing different efforts we are able to reason about the future, a future which sooner or later reflects itself in the built environment.

A conclusion is that the contemporary discussion on architectural research, e.g. Gromark (2000), is a necessity and contributes to a larger common frame of reference of the contents of the research area. A continuous review of what constitutes this frame of reference with society's on-going change is necessary.

A second conclusion is that a certain source of change in the contemporary society is the current and important development of IT. This technology will strongly affect local environment and homes, and people's lives in their homes. This is a prime issue for the architect as a profession and consequently for the development of knowledge in architecture – in other words – for the architectural research.

Acknowledgements

This article derives from current research at the Royal Institute of Technology on IT supported service infrastructures in the built environment, supported by Formas, Vinnova and the Swedish Labour Market Board, which is fully acknowledged.

Notes

1. IT is Swedish for information technology and to "bo" is to live in one's home.
2. SABO is The Association of Municipally Owned Housing Companies in Sweden.
3. "Att ägna sig åt artefaktvetenskap innebär att försöka ge ett aktivt bidrag till konstruktionen av framtiden, genom att bidra till utvecklingen av nya artefakter och nya sätt att använda dem", (Dahlbom, 1993).
4. Castells (1996) means that "the term informational indicates the attribute of a specific form of social organization in which information generation, processing and transmission become the fundamental sources of productivity and power, because of the new technological conditions emerging in this historical period".
5. SABO engaged Notisbolaget, Sandviken for its part of the undertaking.
6. The definition of "broadband connection" is variable. For closer discussion is referred to Keijer (2001).

Stig Gustavsson, B.A. (econ.), doctoral candidate,
Royal Institute of Technology, The Architectural School
stig.gustavsson@arch.kth.se

Ulf Keijer, Prof., Royal Institute of Technology,
The Architectural School
ulf.keijer@arch.kth.se

References

BIRGERSSON, T. & ARMBRUSTER, U., eds. (1994): *Samverkan i lokalsamhället – erfarenheter från utvecklingsarbete med samordnad boendeservice* (Co-operation in the local community – experiences from developing co-ordinated service in housing areas). Rapport 1994:3, Boverket, Karlskrona.

CASTELLS, M. (1996–1998): *Information Age: Economy, Society and Culture.* A triology from Blackwell Publishers, USA.

DAHLBOM, B. (1993): "En vetenskap om artefakter" (A science about artefacts). *Vest* 4:1993, s. 53–75.

GRABHER, G. (1994): "Rediscovering the Social in the Economics of Interfirm Relations". In Grabher, G. (ed) *The Embedded Firm.* Routledge, London.

GRANOVETTER, M. (1973): "The Strength of Weak Ties". *American Journal of Sociology*, Vol.78

GRANOVETTER, M. (1982): "The Strength of Weak Ties: A Network Theory Revisited". I Marsden, P.V. & Lin, M., eds. (1982): *Social Structure and Network Analysis.* Beverly Hills.

GROMARK, S. (2000): "Arkitektur – ett forskningsfält med egenart (Architecture – a research field of its own)". *Nordisk Arkitekturforskning* vol. 2000:1–2. Göteborg.

GUSTAVSSON, S. & KEIJER, U. (1999): *Nya arbeten för funktionshindrade i lokalsamhället. Möjligheter och konsekvenser av IT-stödd service för bostaden och boendet. Förstudie* (New job opportunities for disabled persons in the local society). TRITA-ARK-Forskningspublikation 1999:6, KTH, Stockholm.

HUNHAMMAR, M. (1998): *Utveckling av IT-baserad boendeservice – ett designteoretiskt perspektiv* (Development of IT based services to the tenants – a design-theoretical perspective). Lic-avhandling 1998:5 vid Institutionen för arkitekturens form och teknik vid Kungl. Tekniska Högskolan, Stockholm.

JUNESTRAND, S. (1998): *IT och bostaden – ett arkitektoniskt perspektiv* (IT and the dwelling – an architectural perspective). Lic-avhandling 1998:9 vid Institutionen för Arkitekturens form och teknik, KTH, Stockholm.

JUNESTRAND, S. & KEIJER, U. (2000): "Measuring and Evaluation of ICT-supported Services in the Domestic Environment". *The Proceedings of IFIP 9.3 (HOIT) Conference*, June 28–30, 2000, Wolverhampton.

KEIJER, U. (1995): "Ett individperspektiv för det IT-baserade servicesamhället (An individuell perspective for the IT based service community)". *PLAN* nr 3, 1995.

KEIJER, U. (2001): "Vad skall vi ha bredband till? (Broadband – what and why)" *Väg- och vattenbyggaren* 1/2001.

KEIJER, U. & HUNHAMMAR, M. (1995): *IT-supported Services for the Individual at Residential Living.* The 2nd International Workshop on Potentaial Information Technology for Solving Housing Problems for Aged People. TRITA-ARK-Forskningspublikation 1999:11, KTH, Stockholm.

KEIJER, U. & NILSSON, B. (1996): *Technology, Organization and Market – Application of a Model for Current Business Development for Emerging IT Home-based Services Market.* "The 6th Conference of the Joseph Schumpeter Society on Competition, Entry and Economic Growth – The Firm, the Innovator, the Entrepreneur and Market Competition". TRITA-ARK-Forskningspublikation 1999:12, KTH, Stockholm.

LINN, B., AHLIN, J. & ENHÖRNING, G. (1998): *Arkitekturforskning med betydelse för konst och gestaltning – inventering och kommentarer* (Architectural research of importance for art and design). Chalmers tekniska högskola och Riksbankens Jubileumsfond. Stockholm.

LUNDEQUIST, J. (1995): *Design och produktutveckling – Metoder och begrepp* (Design and product development – Methods and concepts). Studentlitteratur, Lund.

LUSTIG, A., ed. (1995): "New Methods and Technologies in Planning and Construction of Intelligent Buildings". *Proceedings of IB/IC Intelligent Buildings Congress*, Tel-Aviv, Israel 1995.

MOLIN, G. & FRANZON, E. (1997): *Morgondagens Hem. Det mångdimensionella hemmet – basen för livet i det kunskapsindustriella samhället* (The home of tomorrow. The multi-dimensional home – the base for life in the knowledge based society.) Konsultförlaget i Uppsala, Uppsala.

NORDENSTAM, T. (2001): "Om metoden. Fragment ur ett samtal 1973 (On the Method. Fragments of a Dialogue 1973)"."Herr Bos akademi", sid 71–76. Supplement of the journal *Dialoger* 58–59/01.

PETTERSSON, C. (2001): *Datorer åt många – en studie om datorn som vardagsteknik och kunskapsverktyg.* Tema T Rapport 38, 2001. Lic. avh. Fil. fak. Linköpings universitet, Linköping.

PUTNAM, R. D. (1995): "Bowling Alone: America's Declining Social Capital". *Journal of Democracy*. Vol. 6, nummer 1/95.

PUTNAM, R. D. (2000): *Bowling Alone.* Simon & Schuster, New York.

SCHÖN, D. A. (1983): *The Reflective Practitioner – How Professionals Think in Action.* Arena, Guildford.

SIMON, H. A. (1981): *The Science of the Artificial,* 2nd edition. The MIT Press, Cambridge, Massachusetts.

STATISTICS SWEDEN, SCB (2000): *IT i hem och företag.*

STEEN, J. & LINDSTRÖM, L. (2001): *Arbetet bakom näthandel med mat* (Work behind Buying Food on Internet). KFO-LO-PTK Arbetsmiljöfond, Stockholm.
Ordering: jesper.steen@arch.kth.se

WAHLSTRÖM, B. (1996): *En förändrad värld (*A changed world). Liber-Hermods, Malmö.

WIHLBORG, E. (2000): *En lösning som söker problem – hur och varför lokala IT-policyer utvecklas i landsbygdkommuner (*A solution in search for problem. How and why local ICT-policies are developed in rural municipalities). Diss. no. 225, Technology and social change, University of Linköping Linköping.

ÖSTLUND, B. (1995): *Kartläggning med avseende på utvecklingsprojektet IT-BO Vällingby* (A survey with regard to the development project IT-BO Vällingby). Internal report, Technology and Social Change, University of Linköping.