6-30-2011

Heterogeneous Inter-Organisational IT Innovation Creation: Institutional constraints in a public sector oriented market

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Institutional constraints in a public sector oriented market

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Abstract. This paper reports from a case study of an IT innovation consortium in the field of elderly home healthcare. The circumstance of the consortium we studied includes that it was comprised of small-to-medium sized enterprises and targeted a public sector oriented market. We present six institutional constraints facing the heterogeneous innovation collective in the innovation creation process: procurement boundary spanning, procurement tendering and contracts, operation boundary spanning, procurement rationales, market-driven development, development time misalignment. Three of these constraints have a high degree of novelty to the IS literature on innovation. Further, research focused on the field of IT for elderly home healthcare is addressing lack of widespread IT innovation diffusion by turning to user-centered design that emphasises user needs and usability evaluations. This sound approach needs to be complemented by studies that even more emphasise business conditions and commerciability evaluations at field-level; our study contributes in this regard.

Keywords: elderly home healthcare, heterogeneous innovation collective, information technology, institutional constraints, innovation creation, inter-organisational innovation.

1 Introduction

The process of IT innovation comprises the creation and diffusion/adoption of new IT based products and services. Innovation of complex technology systems is often an inter-organisational endeavour, requiring collective achievements by heterogeneous actors (Yoo et al. 2005; Yoo et al. 2008). By heterogeneous actors, we mean organisations embedded in differing technological, social, and economical contexts, thus bringing to collaborations differing technology bases, knowledge resources, and motivations (Yoo et al. 2005; Andersson et al 2008; Yoo et al. 2008). In other words, as types of actors in an organisational field they are structurally nonequivalent (DiMaggio & Powell 1983). Participation in such collaborations where actors have different and sometimes conflicting interests requires, besides technical and economical competence (Andersson et al. 2008), political savvy to understand and influence other actors (Van de Ven 2005).

Inter-organisational innovation collectives can come together under more or less formal arrangements, ranging across informal networking, cluster co-location, joint projects, consortia, and joint ventures. To stimulate innovation, the formation of projects and consortia to create IT innovations is a key target of public research funding. IT innovation collectives can include actors that supply IT products and services, i.e. the supply-push side, and/or actors that use IT products and services, i.e. the demand-pull side (King et al. 1994).

Building theories about diffusion of innovation (Mustonen-Ollila & Lyytinen 2003) and technology acceptance (Venkatesh et al. 2003), IS research on innovation has predominantly focused on how a given product is diffused or not, in a linear sequence (Yoo et al. 2005). Over the years, the analysis level has broadened from individual and organisational adoption (Gallivan 2001) to include industrial adoption (Suarez 2005; Melville & Ramirez 2008). Overall, the focus has been to understand adoption of a single technology application within an organisation or among homogenous firms (Boland et al. 2007).

This extant diffusion-oriented IT innovation literature offers little insight about innovation creation and heterogeneous innovation collectives (Andersson et al. 2008; Yoo et al. 2008). Innovation creation here refers to both the case of a creation phase distinct from a diffusion phase, and to the case of creation being intertwined with diffusion in an emergent innovation process (Yoo et al. 2005; Boland et al. 2007). There are a few recent studies that include focus on IT innovation creation in heterogeneous inter-organisational collectives (Yoo et al. 2005; Markus et al. 2006; Boland et al. 2007; Andersson et al. 2008), and this paper joins that stream of research.

This paper reports from a case study of an IT innovation consortium in the field of elderly home healthcare. The circumstance of the consortium we studied includes that it was comprised of small-to-medium sized enterprises and targeted a public sector oriented market. As engaged scholarship, the study aimed to produce knowledge of relevance for both research and practice. The type of engaged scholarship of this study is practice research, more specifically informed basic research, which "focuses on *understanding* IS practices with the purpose of informing or advising relevant stakeholders" (Mathiassen & Nielsen 2008, p. 6).

The practical need of the heterogeneous innovation consortium was an analysis of the institutional constraints that its innovation creation efforts faced. By institutional constraints, we mean constraints set by institutionalised elements of the social context. Analytically generalized, such an analysis could contribute to the research literature about innovation creation and het-

erogeneous innovation collectives. Thus, with considerable overlap in needs and contributions for research and practice, our study addressed the following research question: *Which are the institutional constraints of IT innovation creation in heterogeneous inter-organisational collectives?*

An institutional perspective can illuminate significant influences in IT innovation processes (King et al. 1994; Orlikowski & Barley 2001; Currie 2009). Institutions are emergent socio-material arrangements that form the structural context of human action at various levels, and influence action in both enabling and constraining ways (Berger & Luckmann 1966; Douglas 1987; Scott 2008). IT innovation creation and diffusion faces institutional constraints that sometimes and to some extent can be overcome through a dialectical process of institutional entrepreneurship (Munir & Phillips 2005; Hargrave & Van de Ven 2006).

The remainder of this paper is structured as follows. First, we continue to present aspects of innovation theory and institutional theory of relevance for our study, followed by the case study context and method. Subsequently, as empirical findings of our case study, we present six institutional constraints facing the consortium in the innovation creation process. Given the situated character of socio-technical innovations (McMaster & Wastell 2005; Munir & Jones 2004), our presentation of constraints as factors is combined with narrative descriptions of their context. Then, in the Discussion section, we assess each constraint's novelty to the IS literature on innovation. We conclude by discussing contributions to research and practice and ideas for future research.

2   Innovation theory

This section outlines further aspects of innovation theory and highlights the key dimensions for our study. As illustrated by Figure 1, the innovation process can be non-linear, in that innovation creation and diffusion are not independent processes, but instead dynamically interrelated through feedback and feed-forward processes (Swanson & Ramiller 1997; Yoo et al. 2005; Boland et al. 2007). Another dimension of non-linearity is when creation and diffusion are intertwined, evolving in a messy and ambiguous way. This is particularly evident with complex technology systems as an ensemble of technological, social, and economical elements (Yoo et al. 2005), and multiple overlapping wakes of innovation across heterogeneous industry networks (Boland et al. 2007).

Innovation creation comprises development of ideas and products. Given the interrelatedness of innovation creation and diffusion, actors' expectations about constraints pertaining to the diffusion phase significantly affect their decisions in the innovation creation phase (King et al. 1994, p. 144). Empirical studies of innovation creation can determine which diffusion constraints are considered by innovation creators, in what way, and under which circumstances. These constraints are in addition to those directly pertaining to the creation phase. The influence of both sets of constraints is illustrated by Figure 1.
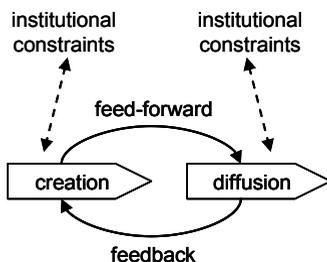
Figure 1: Innovation phases, interrelations, and sets of institutional constraints

Heterogeneity of actors		Distribution of coordination and control	
		Intra-organisational	*Inter-organisational*
	Homogeneous	Singular systems development in organisation or community	Equivalent actors developing common technological platform, e.g. open source
	Heterogeneous	Integrating components from separate business units of large firm	Integrating components from nonequivalent firms, e.g. mobile services

Table 1: Types of innovation collectives (adapted from Yoo et al. 2008)

Our case study context is innovation creation and, as illustrated taxonomically in Table 1, a heterogeneous inter-organisational collective (highlighted in grey).

3   Institutional theory

Our study takes on a broad institutional perspective, concerned with institutions as emergent socio-material arrangements that form the structural context of human action at various levels, and influence action in both enabling and constraining ways (Berger & Luckmann 1966; Douglas 1987; Scott 2008). Barley & Tolbert (1997, p. 96) define institutional structures as "shared rules and typifications that identify categories of social actors and their appropriate activities or relationships", and similarly Teo et al. (2003, p. 21) define the institutional environment of organisations as "widespread social conceptions of appropriate organizational forms and behaviours".

For example, the institutional arrangement of the red-green traffic light system, and its enactment by drivers, traffic lights, police, and other involved actors, rests upon knowledge of its meaning, norms that legitimise its meaning, and regulations that enforce its meaning. This example employs one of the popular categorisations of elements which carry institutional arrangements. Scott (2008) refers to cultural-cognitive, normative, and regulative elements. Gidden's model of structuration refers to interpretive schemes, norms, and resources/facilities (Barley & Tolbert 1997; Jones & Karsten 2008). They differ slightly in that resources is a broader

concept than regulation; regulative power is one type of resource. This tripartite categorisation encompasses the popular bipartite categorisation of laws/rules that regulate and understandings/beliefs that influence (Orlikowski & Barley 2001; King et al. 1994). It also fits roughly with the tripartite categorisation by DiMaggio & Powell (1983) which uses terms that emphasise the manner in which elements affect actors, referring to mimetic, normative, and coercive forces. Coercive forces are also broader than regulation, including both formal and informal pressures. Synthesizing the variety of concepts, Table 2 maps these similar categorisations into a tripartite categorisation of overall institutional elements. This mapping does not break down elements into subdimensions as Scott (2008, p. 51) does.

Element type 1	*Element type 2*	*Element type 3*	
Cultural-cognitive	Normative	Regulative	Scott (2008)
Interpretive schemes	Norms	Resources / facilities	Barley & Tolbert (1997)
Mimetic	Normative	Coercive	DiMaggio & Powell (1983)
Beliefs that influence		Rules that regulate	Orlikowski & Barley (2001)

Table 2: Categorisations of elements which carry institutional arrangements

Often institutional arrangements are carried by a combination of elements as "the three types intermingle in empirical setting" (DiMaggio & Powell 1983, p. 150) and can form a complex "web of …norms, rules, beliefs" (Barley & Tolbert 1997, p. 93). However, it can also be possible to identify single elements as dominant.

Institutional arrangements are constructed and operate at different levels of social actors (Scott 2008). Relevant actors may be individuals, groups, organisations, or larger collectives, and an institution may be associated with a group, an organisation, an organisational population, an organisational field, a society, or world system (Barley & Tolbert 1997; Scott 2008). Our case study inquired for institutional constraints at all levels, but data collection and findings nonetheless emphasised institutional constraints associated with the organisational field of elderly home healthcare. Organisational field is defined as "those organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services and products." (DiMaggio & Powell 1983, p. 148; see also Scott 2008).

Institutional structure and action are reciprocally related; structure influences action, and emerges from its enactment in action (Barley & Tolbert 1997). Structures are sometimes mediated by technology, whether viewed as embedded or inscribed in technology (Orlikowski 1992) or enacted in technology use (Orlikowski 2000). Our study does not analyse this dynamic of structuration, but instead focuses on identifying institutional structures and their constraining influence on actions of innovation. As outlined in previous sections, the relevant actions and structures of innovation creation pertain to both the innovation creation phase and, through expectations, the diffusion phase. Using the metaphor of Weber (in DiMaggio & Powell 1983), significant institutional constraints can be described as forming an iron cage around innovation creation.

Neo-institutional theory has predominantly focused on explaining isomorphism and irrationality (Munir & Jones 2004). However, our definition of institutions in innovation is not limited to the case of isomorphic pressures leading to similarities of organisations (DiMaggio & Powell 1983; Teo et al. 2003), nor limited to the case of legitimate habits that are irrational in terms of efficiency gains (Avgerou 2000; Barca & Cordella 2006; Mignerat & Rivard 2009). Social systems of rationality, efficiency, and competition, are socially constructed and institutionalised (Polanyi 1958; Berger & Luckmann 1966); thus rational behaviour is shaped as much by institutional arrangements as behaviour perceived as irrational is. In this regard, DiMaggio & Powell (1983, p. 149) "question the utility of arguments about the motivations of actors that suggest a polarity between the rational and the nonrational", and Scott (2008, p. 217) describes an extension in view "from institutions as irrational influences to institutions as frameworks for rational action".

Our case study was guided by the institutional perspective outlined above. For our analysis, key sensitising concepts were the tripartite categorisation, the metaphor of constraints as an iron cage, and examples of institutional arrangements given by extant IS research, of which some are listed below. This framework is illustrated in Figure 2.
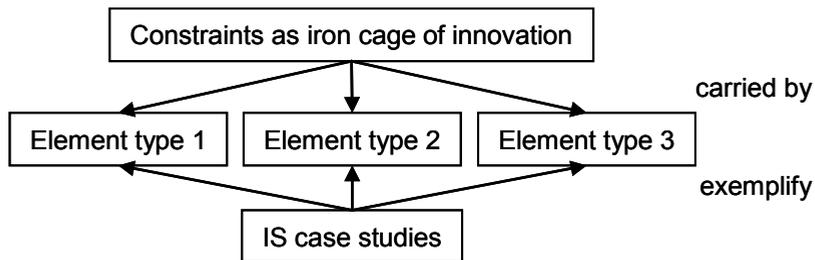

Figure 2: Conceptual framework for our case study analysis of institutional constraints

EDI adoption decisions are pressured by for example perceived adoption among competitors, dominance of partners, and norms of industry associations (Teo et al. 2003). Behaviour can become inscribed and thus entrenched in standards for EDI messages (Hanseth & Monteiro 1997). Given legitimacy by the broader IS discourse in industry and academia, organisational commitment to IT as enabler of, and the IS function as driver of, organisational change can prevail uncritically (Avgerou 2000). Technology users' assumptions about appropriate ways to use certain technology can constrain technology use to fit with established social practices (Munir & Phillips 2005). Highly regulated judicial procedures in the justice system constrain technology use to fit with legal requirements for user access and identification (Contini & Lanzara 2009). Government regulations such as requiring use of particular products and government influences such as providing R&D subsidies (King et al. 1994). In organisations with decentralised control, a prevailing culture of departmental independence and concern is a challenge for the implementation of enterprise systems that push for more homogenous practices (Barca & Cordella 2006). Telehealth innovations can fail to diffuse if their funding scheme does not align with the industry field funding scheme based on insurance reimbursement (Cho & Mathiassen 2007).

4 Methodology

4.1 Research approach

Our study is positioned as informed basic research in the IS research discipline, aiming to produce knowledge of relevance for both research and practice (Mathiassen & Nielsen 2008). The research approach is interpretive (Walsham 1995; Klein & Myers 1999) and employs qualitative methods of data collection and analysis (Patton 2002).
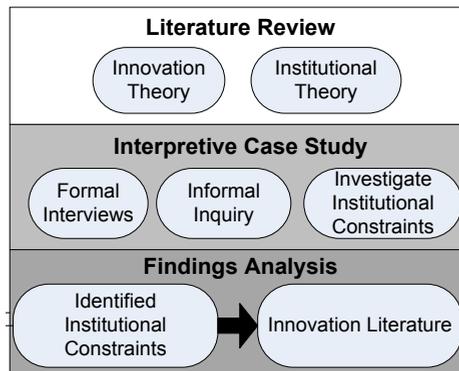

Figure 3: Research method

The three sequential stages of activities outlined in Figure 3 reflect the research method of our study. First, we reviewed the extant theoretical foundation concerning institutional constraints in heterogeneous inter-organisational IT innovation creation. This was followed by an interpretive case study of an IT innovation consortium. It included both formal and informal data gathering activities, and institutional analysis of the case data. Finally, the case study findings resulted in identification of institutional constraints that were subsequently mapped to the IS literature on innovation.

4.2 The case of IT innovation in elderly home healthcare

We conducted an interpretive case study of an IT innovation consortium in the field of elderly home healthcare in Sweden. This field is subject to an increased amount of innovation efforts, fueled by a growing need to care for the rapidly increasing proportion of elderly people in the populations of the industrialized world. For example, over the next decade the number of people aged 65 years or older will increase by 20 percent in Sweden.

Different countries have different social structures to provide care for the elderly. In northern Europe, including Sweden, the public sector plays a relatively big role in providing healthcare

services to elderly in their own homes or residential care homes. One strategy is to enable elderly to live in their own home as long as possible rather than move to a specially equipped and staffed residential care home. This is less costly for the public sector and preferred by most elderly people.

Technology can enable elderly to keep living in their own home, by compensating for impaired functions and by supporting activities that give meaningfulness to life. Existing technology applications include security alarms, cognitive stimulus tools, hearing aids, telemedicine, telecommunication, medication dispensers, and service information. Further, applications to support administration and operations of home healthcare staff enable the public sector to produce more care services with fewer resources; for example, resource planning, mobile report submissions, and digital door locks.

We studied an innovation consortium, launched in early 2007, over the first six months of its existence. The aim of the consortium was to develop new applications to support elderly living in their own home. On the demand-pull side, the consortium involved elderly people, municipal home healthcare, municipal housing, and county development. On the supply-push side, there were providers of technology applications and components. Table 3 lists anonymised and descriptive names of the actors. There was no severe competition between actors; the two suppliers of security alarms focused on different niches.

Technology users/customers	Number of interviewees
Elderly and relatives	0
Municipal home healthcare	2
Municipal housing	2
Technology application suppliers	
Security alarm applications	1
Security alarm and aid applications	1
Door lock applications	1
Hearing aid applications	1
Medication dispenser applications	0
Technology component suppliers	
Home alarm components	1
Tracking and sensor components	1
Wireless communication components	1
Technical consultant (medical)	0
Technical consultant (general)	0
University alpha research	0 (informal conversations)
Others	
County development	0 (informal conversations)
University beta research	0
Research institute	Authors' affiliation

Table 3: Participating organisations and number of interviewed persons

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The consortium was formed around a six month project targeting elderly home healthcare. However, since its backdrop was an existing, larger, and longer-term consortium focused on healthcare technologies in general, and since the ambition was to secure public research funding to extend the project by two years (which was later accomplished), it is fair to consider the time-plan for developing new products to have been one year. The consortium process aimed to cover idea generation, application development, and implementation, and the development approach was based on user-centered design. During the first six months, the process came so far as to investigate user needs in two areas. The first area focused on technology for fall-accidents; a focus group of healthcare staff, technology suppliers, elderly, and University Alpha researchers, discussed user needs in different fall-accident scenarios. The second area was facilitated by University Beta researchers, who trained user groups, including elderly and six types of healthcare staff, to use voice diaries to record their thoughts about needs in everyday work and life. The facilitator compiled the needs as input for workshops with technology suppliers. The consortium was also engaged in side-track processes. First, there were various seminars to inspire, inform, and coordinate. Second, a standing apartment exhibition with various existing technology applications installed was created and used as demonstrator and education setting. Third, originating from concerns about technology integration, our study (performed by Research Institute) charted institutional constraints that the consortium faced.

The larger consortium focused on healthcare technologies in general comprised 50 companies, the county, and all municipalities and University Alpha within the county. Many but not all participants in our study were also members of the larger consortium, which was further related through having technology for elderly home healthcare as one focus area. So the background of the consortium that we studied was high regional commitment, a track record of successful product development and commercialisation, and competitive research funding applications at national and European levels.

4.3   Data collection and analysis

Data was primarily collected through semi-structured telephone interviews, each lasting 60 to 90 minutes, with 11 interviewees representing 9 of the organisations (see Table 3). In all organisations, interviewees included the CEO. Secondary data was collected from the technology providers' websites, conversations at a trade fair, conversations with University Alpha Research and County Development staff, and participation in two consortium seminars. We also conducted a semi-structured telephone interview with an IT consultant in the elderly home healthcare field, to gain an initial understanding of the field. All interviews were recorded and transcribed; thereafter content analysed together with secondary data. The interview quotes in this paper have been translated, and paraphrased for brevity.

The primary data source reflects a senior management perspective of various organisations in the consortium. We believe these seasoned business leaders were able to provide valid accounts about their organisations and much of the organisational field. Hence, our unit of analysis is multi-level; indeed, our study inquired for institutional constraints at all levels, but nonetheless emphasised the field level. The exclusion of interviews with both organisations outside the consortium and individual technology users is a limitation of our method.

The data collection and analysis process searched for factors that significantly influenced the stakeholders' innovation efforts. We did not search for any specific institutional factors determined a priori but rather allowed the data to 'speak for itself' within a perspective sensitized to institutions. The interview questions were open-ended, avoiding to lead respondents to overemphasise institutional constraints. At the same time, open-endedness was not dogmatic; when necessary, we allowed ourselves to probe deeper into constraints as they emerged and even to ask somewhat leading questions. For our analysis, key sensitising concepts were the tripartite categorisation, the metaphor of constraints as an iron cage, and examples of institutions (Figure 2).

The interview guide was slightly adapted for municipal home healthcare, municipal housing, suppliers of technology applications, and suppliers of technology components. The questions covered the innovation system areas of market, technology providers, technology infrastructure, and consortium. The first three areas are in line with the system view of Andersson et al. (2008) which refers to markets, industry relationships, and technologies. The areas can also be roughly mapped to the system view of Alter (2002) which refers to customers, participants, technologies, and process. Within each area, the questions ranged across technological, social, and economical dimensions (in line with Yoo et al. 2005). These are relevant dimensions of IT innovations, reflected popularly as dimensions of innovation feasibility studies.

5 Findings

Each of the following subsections describes a particularly salient institutional constraint that the innovation consortium faced. This section is limited to empirical findings and the next section (Discussion) presents implications for theory; academic readers may wish to read across these sections for each constraint in turn.

5.1 Procurement boundary spanning

Various technology applications in the home healthcare area could benefit from being combined into integrated systems. Examples of potential integrations were (1) security alarms and hearing aids, and (2) security alarms and stove guards. Despite user needs such integration was not created and marketed by technology providers. One barrier was that procurement of the separate technologies was the responsibility of separate procurement organisations in the public sector.

> "They need a stove guard with a security alarm, when they have become semi-demential so they sometimes forget the stove. Stove guard is a housing adaption and then it's not the same individual that decides about the security alarm that decides about the stove guard." (Supplier of security alarm applications)

> "If you want a security alarm, then you have to contact an aid handling officer [at municipal home healthcare] and they conduct an individual appraisal. Hearing aids don't go through the work therapist; rather, then you have to contact the hearing aid central." (Municipal home healthcare)

Figure 4 illustrates some of the procurement organisations, some of the technologies that belonged to their responsibility areas, and the disconnect between them.
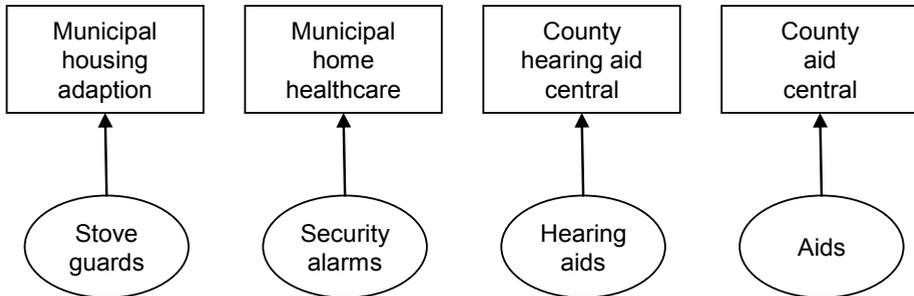

Figure 4: Procurement boundaries and technology boundaries

Security alarms were procured by municipal home healthcare, hearing aids by county hearing aid centrals, and stove guards by municipal housing adaption. Consequently, technology providers who wished to market integrated systems were required to create a sales organisation that targeted multiple procurement organisations and coordinated the sales processes. Technology providers who were not prepared to engage in such a boundary spanning sales process avoided creating integrated systems.

> "If one has a complete system, then perhaps each part of the system will be decided upon by two to three different decision makers. That process becomes so sluggish that no company has the energy to try to sell such things. And then they don't invest in development in that segment either." (Supplier of security alarm applications)

> "Unfortunately very little of that [integrations]. There have been fairly watertight boundaries between the alarm market and us that have worked with special adaptions [hearing aids]." (Supplier of hearing aid applications)

In sum, the boundaries of disconnected procurement organisations effectively came to define the boundaries of technology applications and constituted a strong barrier against integrated solutions. We label this institutional constraint of innovation creation as *procurement boundary spanning*. The organisational field thus had a structure of procurement boundaries and technology boundaries that influenced innovators to avoid developing boundary-spanning technology applications at odds with that structure. Technology suppliers were guided by knowledge of boundaries and the norm that boundary-spanning was business nonsensical. The structure was however mainly upheld by the organisation of public sector procurement, reflecting the resource of budgetary allocations, habitual responsibility areas, and further elements promoting divisionalisation and knowledge specialisation.

5.2   Procurement tendering and contracts

Except for small purchases (e.g. pilot projects), the public sector was required to have an open procurement process based on requests for tenders, evaluation of submitted tenders, and contract awarding for the tender that would give best value for money. The tendering process was decentralised to the 21 counties and 290 municipalities, and tenders were for three-year contracts (framework agreements).

> "The counties are publicly procured, either for themselves or together. About two to three year contracts. Some counties procure a broad variety of products and others are stingy, which of course is reflected in what patients get or don't get." (Supplier of hearing aid applications)

> "The door lock application we are testing, the mobile report application we are testing, and that is allowed before the tendering process. For this, there are threshold values to comply with." (Municipal home healthcare)

This innovation environment of tendering for decentralised and long-term contracts created a first mover disadvantage for explorative innovations without imitation barriers and lock-in effects. An example of such an innovation was the potential shift from analog to digital communications (Internet Protocol) for security alarms. The requests for tenders, and non-confidential parts of tenders, were openly available for competitors to study. Hence, competitors could identify new features of a first mover innovation and subsequently develop their own products to incorporate those features. This means that competitors were only investing to develop features that customers had been proven willing to purchase. The first mover, on the other hand, may have invested in several developments before finding what customers would purchase. Being a second mover made business sense because of the openness of tendering information, and because, with 290 municipalities, second movers may lose one contract due to not being first to offer new features but they still would have 289 contracts left that they could win. In addition, long-term contracts slowed down market shifts and gave second movers time to catch up. While there was some coordination through duplication of tenders and bids for multiple counties or municipalities, we emphasise in our analysis the principal point about a strongly decentralised tendering process.

> "We did not invest in building an ISDN interface. That was probably good because there have never been sold any security alarm telephones with ISDN interface. To launch an IP telephone today, that can be a direct hit but it can just as well be a wasted investment. It is perhaps better to develop the second generation IP-based security alarm telephones that utilise experiences from mistakes made by those in the absolute lead… Moreover, we only need to read requirement specifications in a tendering process to know exactly what is valid in the current situation." (Supplier of security alarm applications)

On the other hand, first mover advantage seemed to be possible for innovations with imitation barriers and lock-in effects. For example, providers of security alarms developed proprietary communication protocols to support new functionality so that product interoperability and

interchangeability was hindered for competitors. Furthermore, protitols were often encrypted to make it difficult for competitors to reverse-engineer compatible features.

> "They develop secret protocols that the other companies try to break and they develop new functions that the others copy and so on. Through proprietary qualities they try to lock in customers and exclude the others. One justifies it through introducing new functions, so that customers get an added value in some situations." (Supplier of security alarm applications)

A second example is that one technology application provider (not in the consortium) marketed an integration between its security alarms and its resource planning system for municipal home healthcare. The proprietary nature of the complete system raised the imitation barriers, especially considering that most competitors offered either security alarms or resource planning systems but not both. A third example is that the door lock application provider was in the midst of developing an integration between their key administration system and another provider's resource planning system. The imitation barrier was that their door lock application was unique and patent protected. While construction of barriers is also motivated by competition issues beyond tendering, we can see that it served to mitigate first mover disadvantage associated with the tendering process.

In sum, long-term contracts and decentralised procurement contributed to first mover disadvantage for explorative innovations without imitation barriers and lock-in effects. We label this institutional constraint of innovation creation as *procurement tendering and contracts*. The organisational field thus had a structure of procurement routines and technology propriety that cautioned innovators from making first mover investments. Technology suppliers were guided by knowledge of this and the norm that explorative first moves without innovation barriers were business nonsensical. The structure was also upheld in the public sector mainly by legal requirements for procurement tendering, combined with decentralised procurement that seemed legitimised normatively by the view that regions differed in terms of requirements, resources, and priorities.

5.3   Operation boundary spanning

The core elements of security alarms in elderly own homes were (1) a mobile device carried by elderly for activating an alarm message and (2) a base device for receiving the alarm message and presenting it to someone that responds by going to the elderly. The receiver/responder was often the municipal home healthcare but could also be a relative.

The dominant architecture of security alarms used short-range wireless communication for the mobile device, which restricted its usage area to the home and its closest surroundings. One innovation idea in the consortium was to extend the mobile device features to include an automatic fall-detection alarm, and to extend the usage area because many fall-accidents occur away from home.

Extending the usage area would technically involve utilising GSM or similar wide-area connectivity. The constraint that kept consortium actors from developing this innovation was of an organisational nature. With the dominant architecture, the fixed alarm location meant that

it was always clear who should respond. If the usage area was extended, then it needed to be worked out who should receive the alarm and who should respond when the location was away from home.

> "Who will pay for it? And who is responsible to turn out on this alarm when this individual has fallen in his summer cottage on Remote Island; he who really lives in Malmö city? It is those things that prevent commercialisation of a portable alarm." (Supplier of security alarm applications)

It was beyond each municipal home healthcare department's operation boundary, in terms of responsibility and budget, to respond to alarms away from homes in its municipality. Resolving who should receive and respond to alarms away from the homes was complicated by the high number of municipalities affected (290) and the increased cost that the innovation was likely to place upon the municipalities.

> "It becomes an increased pressure on nursing staff if one also must take care of what happens outside the home." (Municipal home healthcare)

The increased cost was related to that when elderly needed help away from their homes they could call the basic emergency services (or relatives) with their mobile phones. The emergency services were managed and budgeted by the 21 counties, and were thus completely distinct from the municipal home healthcare. The operational boundaries between municipal and county organisations were highly sedimented and complex to adjust, due to factors like separate political leadership, separate tax revenue sources, different economical incentives, and separate information systems.

A potential responder to alarms in housing areas was municipal housing providers since they already contracted staff that responded to disturbances among tenants (e.g. noisy parties). This was discussed in relation to both wide-area connectivity and privately purchased security alarms without response service offered by municipal home healthcare. It was however an unlikely option, not least due to their lack of both medical knowledge and access to medical records.

> "For service apartments, alarms go to the emergency central and then some home healthcare team turns out. But when the municipality does not provide this, then we have not solved this question of who takes care of the alarm." (Municipal housing)

> "Is it the housing providers that should get something together? It's a big responsibility. The municipal home healthcare knows the care." (Municipal home healthcare)

In sum, technological innovation was held back by dependency on inter-organisational innovation that spanned across and required adjustment of operation boundaries. We label this institutional constraint of innovation creation as *operation boundary spanning*. The organisational field thus had a structure of operational boundaries that influenced innovators to avoid developing boundary-spanning innovations at odds with that structure. Technology suppliers were guided by knowledge of boundaries and the norm that boundary-spanning was business nonsensical. The structure was however mainly upheld by the organisation of public sector operational boundaries, reflecting a complex web of institutional elements promoting divisionalisation, budgetary care, and habitual responsibility areas.

5.4   Procurement rationales

Procurement rationales are a combination of customers' procurement incentives, funding models, and requirements. We identified three customer segments, each with distinct procurement rationales that technology providers needed to target. Each rationale could be satisfied independently of the others. The segment of public healthcare and its procurement rationale of rationalisation is described in the following. Readers with particular interest in the field of IT for elderly home healthcare may find the other two procurement rationales interesting; need satisfaction for private consumers and investment payback for public housing are described in the Appendix.

The municipal home healthcare was funded by budget allocations based on municipal taxes. They were under continuous pressure to make more efficient use of resources. Hence, public healthcare had a procurement rationale of efficiency and rationalisation.

> "There is really only one thing that has to be in place and that is the security alarm. I have talked to suppliers of different products and they can be sold [to municipal home healthcare] but one maybe doesn't get any large volumes. There is a need within elderly care but at the same time it costs money and the budget is limited." (Supplier of door lock applications)

The healthcare department in the consortium had increased its IT budget and procured a number of new technology applications. The business case for technology investment was to enable elderly to live longer in their own homes, which cost less than a residential care home, or to rationalise operations and administration.

> "With public economy in mind, one should make sure there is not unnecessarily a lot of residential care homes. It is also about life quality, that is to say that people should not be forced to move to a residential care home." (Municipal home healthcare)

> "They realise how much time they spend on key handling and driving and fetching and leaving keys. For that reason it's easier for us to sell our product." (Supplier of door lock applications)

While county aid centrals also had a purchasing rationale of efficiency, they were not motivated to push for rationalisation of elderly home healthcare since responsibility for this area belonged to municipal healthcare. Consequently, innovations in technologies such as hearing aids, that may enable elderly to live longer in their own homes, were likely to remain unfunded by county hearing aid centrals. At the same time, municipal healthcare investments were likely to avoid these technologies because they were a county-level procurement responsibility.

> "Counties are clearly going towards a trend where one purchases that which is absolutely needed, and are very focused on price... The municipalities are responsible for residents in the homes but at the same time it's the counties that pay a part of the individuals' possibilities to keep residing in the homes. If a county is stingy with hearing aids, then this could mean that the patient has to move from home prematurely and add load to a municipal residential care home." (Supplier of hearing aid applications)

In addition to rationalisation, the procurement rationale of municipal healthcare required that technology applications were easy to use. Further, purchasing versus leasing technology applications was a trade-off; purchasing gave a lower total cost but leasing helped avoid large upfront investments.

In sum, value propositions need to fit with customers' procurement incentives, funding models, and requirements. In the studied case, this was much about rationalisation for public healthcare, need satisfaction for private consumers, and investment payback for public housing. We label this institutional constraint of innovation creation as *procurement rationales*. The organisational field thus had a structure of legitimate procurement rationales that innovation development needed to target. Technology suppliers were guided by knowledge of rationales and the norm that satisfying procurement rationales was business prudent. The specific structure of the three procurement rationales were mainly upheld by institutional elements of the three customer segments. For instance, rationalisation for public healthcare reflected the resource of budgetary allocations, norm of budgetary care, and normative legitimacy of investing for rationalisation, and further elements promoting divisionalisation and knowledge specialisation.

5.5 Market-driven development

The technology providers in the consortium were small-to-medium sized companies with limited resources. They emphasized that development activities needed to be based on commercially viable ideas. They would not invest in development unless there was a good chance for the innovation to sell.

> "If there are needs… business opportunities in taking some development part in something, then I'm prepared to try it. One tries to gather as much facts as possible that indicate that there is a deal over there." (Supplier of hearing aid applications)

> "They want that one should be able to promise that one will purchase X number of products, and we can never do that because we must have a tendering process. I understand that they don't dare put millions on product development when they are not sure there can be a sale." (Municipal home healthcare)

Hence, technology providers wanted to understand market needs and engage in dialogue with customers about potential innovations.

> "That one produces business models that are products applicable in the market… tested against customer groups, so one does not put time and money on something that will not be used." (Supplier of tracking and sensor components)

> "We join projects like this to get feedback and possibility to see potential in new products. We also work close to our customers, and if one has received an inquiry about a product enough times, then one also sees a need." (Supplier of security alarm and aid applications)

One of the small technology providers enacted an extreme version of this normative view, only engaging in development that was directly funded by customers.

"If a customer wants an integration then we will do that integration, but someone must pay for the time it takes. Either that customer or divided across five or ten customers." (Supplier of door lock applications)

In sum, technology providers held a normative view to limit the economical risk of their investment through cautious exploration targeting market needs. We label this institutional constraint of innovation creation as *market-driven development*. The organisational field thus had a structure of legitimate development methodology that innovation development needed to conform to. Technology suppliers held the norm that market-driven development was business prudent, and this was echoed by the researchers' norm of user-centered design as targeting market needs, i.e. both customers/sponsors and end-users. Further, technology suppliers were informed by knowledge of market risks, where lack of guaranteed deals was tied to regulation for procurement tendering.

5.6 Development time misalignment

As the project progressed, it became clear that consortium actors had to consider other business development activities in their development portfolios. For technology providers, six to twelve months was a short time and customer-funded developments were likely to get priority.

"Medication Dispenser Applications have a lot happening in the company right now, so the project has not gained access to that company as much." (Municipal home healthcare)

"I have not had time to drive the contact with Security Alarm Applications properly, even though they seem to be a very interesting company to collaborate with." (Supplier of wireless communication components)

While the technology providers' priorities were driven by their limited resources, the municipal housing provider's priorities were dependent on its political governance process. As a public sector organisation, it was governed by directives from the municipal council and at a lower level by strategies from its board of municipal politicians. It would take until at least six months into the project until this two-stage governance process would decide how much responsibility the housing provider should assume for elderly tenants. Until then, the housing provider could not take any development initiative.

"That debate is going on now [in the municipal council]. There are two proposals for owner directives from the different sides." (Municipal housing)

"These strategic directions will be decided by the board around summer; shall we commit to technology installations and senior housing?" (Municipal housing)

While the development priorities described above seem to play out in the short term, the issue of heterogeneous development cycles, described in the following, seems to be more long term. Some technical innovations might require apartment modifications such as building communication cables into walls. Apartment modifications were typically very expensive compared to when building new apartments. Therefore, housing providers sought to build it right from the start and avoid modifications.

> "If one installs networks, then it's less expensive if one does it when the house is being built... When one anyway does something and then do this little extra, then it becomes a marginal cost. But if one shall only do this, then it becomes terribly expensive. For example, we are renovating bathrooms. We have in conjunction with this taken the chance to adapt those bathrooms for availability." (Municipal housing)

The housing provider in the consortium had recently modified their apartments to include broadband cable connections. This large investment had a payback period of about 30 years, funded through a rent hike. Additional modifications such as building in another type of cable were highly unlikely for many years to come.

> "We are finished investing when it comes to networks and sockets, for a large number of years ahead." (Municipal housing)

The long development cycle of housing providers, based on high costs of apartment modifications and long payback periods, meant that it was important for them to figure out what tenants would need decades into the future. It also meant that while technology providers could quickly (one to two years) develop technical innovations, the innovations might be dependent on apartment modifications that could not be implemented in the foreseeable future. Thus, certain kinds of joint innovations needed to consider the actors' heterogeneous development cycles due to interplay between high and low velocity industries.

> "When we do a large reconstruction or build a new, then this is supposed to stand for 30-40 years before one does something radical with it again. That means we must think about how it looks 20 years ahead… to offer housing that fits with the [future] demand." (Municipal housing)

In sum, there were incongruences in time-alignment of consortium development activities with actors' other business development activities and cycles. Actors had to await the right time for development, due to limited resources, governance processes, or heterogeneous development cycles. We label this institutional constraint of innovation creation as *development time misalignment*. The organisational field thus had a structure of legitimate actor priorities that meant engagement in consortium development was put on hold. It was normatively legitimate to give priority to other business development activities, political governance process, or long development cycles. The political governance process rested on its regulations, and technology suppliers and housing provider were guided by the norm that such priorities made business sense. We presume also that the housing provider was guided by the norm of budgetary care.

6   Discussion

6.1   Procurement boundary spanning

The institutional constraint of *procurement boundary spanning* refers to procurement organisation boundaries as barriers against technology integration. We have not identified literature about this institutional constraint, which concerns integration of heterogeneous technologies. This is different from procurement organisation boundaries in the context of implementing enterprise systems, a homogenous technology, across decentralised departments (Barca & Cordella 2006). In that context the barrier prevents practice integration rather than technology integration. Rolfstam et al. (2011) describe three procurement channels to UK hospitals but they are parallel rather than disconnected, i.e. different ways for homogenous technologies to reach hospitals. Distantly related literature concerns centralisation versus decentralisation of IT governance (Brown & Grant 2005; Barca & Cordella 2006), and architectural knowledge in boundary spanning integration (Andersson et al. 2008; Henderson & Clark 1990). Hence, this institutional constraint reported by our study has a high degree of novelty to the IS innovation literature.

6.2   Procurement tendering and contracts

The institutional constraint of *procurement tendering and contracts* refers to first mover disadvantage for explorative innovations without imitation barriers and lock-in effects, due to long-term contracts and decentralised procurement. There is literature about first mover advantage in relation to network and lock-in effects (Arthur 1989); related concepts are disruptive innovation (Nault & Vandenbosch 2000) and dominant designs (Suarez 2004). However, the relationship to tendering and contracts has hardly been reported previously. The innovation constraining elements of long-term contracts, decentralisation, and open tender proposals, are mentioned by Vinnova (2007) but that study does not tie the elements together. Rolfstam et al. (2011) identify long-term contracts as a constraint in healthcare innovation diffusion but not in relation to first mover advantage. Hence, this institutional constraint reported by our study has a high degree of novelty to the IS innovation literature.

6.3   Operation boundary spanning

The institutional constraint of *operation boundary spanning* refers to technological innovation held back by dependency on inter-organisational innovation that spans across and requires adjustment of operation boundaries. While not reported as an innovation barrier, Boland et al. (2007) describe necessary changes in inter-organisational operation boundaries accompanying the introduction of a collaboration system, in the context of an emergent innovation process where creation and diffusion were intertwined. It is also well-known that, in both public and

private sectors, intra-organisational enterprise systems can require adjustment of work routines and boundaries (Volkoff et al. 2007; Barca & Cordella 2006). Tension concerning such adjustment between home healthcare and telecare departments are described in a case of telecare implementation (Boonstra & van Offenbeek 2010). In the case of this institutional constraint, we do not think there is much difference in essence between inter-organisational and intra-organisational contexts; except that the former context may tend to be more rigid and harder to overcome. Hence, this institutional constraint reported by our study has a low degree of novelty to the IS innovation literature.

6.4   Procurement rationales

The institutional constraint of *procurement rationales* refers to that value propositions need to fit with customers' procurement incentives, funding models, and requirements. This is consistent with extant innovation literature, which has demonstrated that effective business models, including value propositions, are necessary to render value from technology innovation (Chesbrough & Rosenbloom 2002; Jonsson et al. 2008). In this regard, Cho & Mathiassen (2007) emphasise a funding model of insurance reimbursement and Contini & Lanzara (2009) emphasise legal requirements for user identification in judicial procedures. Successful value propositions, or product offerings, tend to be incremental innovations and solve customer problems (Goldenberg et al. 2001). In the context of heterogeneous inter-organisational IT innovation creation, Andersson et al. (2008) use the terms business model understanding and use context sensitivity when pointing out the need for innovators to have knowledge about procurement rationales. Hence, this institutional constraint reported by our study has a low degree of novelty to the IS innovation literature.

6.5   Market-driven development

The institutional constraint of *market-driven development* refers to a normative view to limit the economical risk of investment through cautious exploration targeting market needs. This is consistent with extant innovation literature, which has showed that product development is typically driven by market needs and concept testing (Goldenberg et al. 2001), even in the resource-strong and creative video games industry (Tschang 2007). Customer involvement (Nambisan 2002; Henfridsson & Lindgren 2010) and tuning in to the industry organising vision discourse (Swanson & Ramiller 1997; Yoo et al. 2005) help to focus development on market needs. Hence, this institutional constraint reported by our study has a low degree of novelty to the IS innovation literature.

6.6   Development time misalignment

The institutional constraint of *development time misalignment* refers to incongruences in time-alignment of consortium development activities with actors' other business development activities and cycles, due to limited resources, governance processes, or heterogeneous development

cycles. Silva & Hirschheim (2007) describe how political timing in public sector governance can trigger or halt intra-organisational innovation projects. The difference between high and low velocity industries has been investigated (Nadkarni & Narayanan 2007), but the interplay between high and low velocity industries in joint innovation has only received scant attention through recent studies of car manufacturing industry interplaying with software industry, in which traditional hardware component modularity meets tensely with emerging software service-oriented modularity (Andreasson & Henfridsson 2009; Svahn et al. 2009). Distantly related literature concerns intra-organisational project portfolio management (McFarlan 1981), strategic alignment (Avison et al. 2004), and the relationship between infrastructure and application development (Star & Ruhleder 1996; Hanseth & Lyytinen 2004). Hence, this institutional constraint reported by our study has a high degree of novelty to the IS innovation literature.

7 Conclusion

7.1 Contributions

Our study addressed the following research question: *Which are the institutional constraints of IT innovation creation in heterogeneous inter-organisational collectives?* Based on findings from a case study, we have described six such institutional constraints. We believe most of the constraints can have relevance beyond this context, so in assessing their theoretical novelty we have mapped the constraints to the broader IS literature on innovation. As summarised in Table 4, three of the constraints have a high degree of novelty to this innovation literature. The three constraints with low novelty confirm findings in extant literature; this has value, in particular concerning the context of IT innovation creation in heterogeneous inter-organisational collectives.

Institutional constraint	*Novelty to IS literature on innovation*
Procurement boundary spanning	High
Procurement tendering and contracts	High
Operation boundary spanning	Low
Procurement rationales	Low
Market-driven development	Low
Development time misalignment	High

Table 4: Theoretical novelty of institutional constraints

The empirical findings and theoretical implications of our case study add to the IS literature on innovation; particularly concerning IT innovation creation and heterogeneous innovation

collectives. Our study has proved the factors' significance in this context and captured not only the abstract factors but also the situated reasoning concerning them.

At the level of abstract factors, we believe most of the constraints can have relevance also in contexts of diffusion, homogeneity, and intra-organisation. It may however be hard to come across some of the constraints in these other study contexts. One reason is that studying the diffusion of given products cannot capture the constraints of products that are never developed. The constraints may also play out rather differently in the different contexts.

We believe that our study also makes a contribution to research focused on the field of IT for elderly home healthcare. This research is addressing lack of widespread IT innovation diffusion by turning to user-centered design that emphasises user needs and usability evaluations (Koch 2005). This sound approach needs to be complemented by studies that even more emphasise business conditions and commerciability evaluations at field-level. Koch (2005) points out that "…evaluation papers, they merely reflect usability tests on minor populations", and calls for "deeper evaluation… large scale, long term empirical studies" and broader consideration of "legal, ethical, organizational, clinical, usability and technical aspects" including privacy and payment issues. This has parallels with Vimarlund & Olve (2005) who call for comprehensive economic evaluations that consider "large-scale redesign of organizations and work practices" and "efforts needed to enable the change: overcoming user resistance, training and technical support, and achieving management support". Our study is a contribution in this regard, and implies the relevance of investigating how public sector reorganisation could alter the institutional constraints of innovation.

The practical contribution of our study is (1) an analysis framework comprised of six constraints and (2) a narrative description of empirical constraints that can be used as a teaching case. As an analysis framework, it can help focus search for these constraints and offer an understanding of them. IT innovation creation efforts in the field of elderly home healthcare can analyse their situation in terms of the six institutional constraints at both the level of abstract factors and the level of situated narrative descriptions of factors; this was the practical contribution to the studied consortium. At the level of abstract factors, the analysis framework can be relevant to apply in a variety of empirical fields. Finally, one practical implication of our study is that the public sector should build awareness of how its institutional structures affect technology design and innovation at industry-level.

7.2 Future research

Our findings suggest several avenues for future research. First, focusing on the three institutional constraints that have a high degree of novelty to the IS literature on innovation, and building on our findings, in-depth studies can create comprehensive theories about: How procurement organisation boundaries influence the way that IT providers develop and market technologies, and through that promote technology integration or separation; How procurement tendering and contracts affects first mover advantage in IT innovation; How limited resources, governance processes, and heterogeneous development cycles create development time misalignments that constrain joint innovation. Such studies could also explore the more indirect conceptual links to what we refer to as distantly related literature. It could also be timely for procurement-related

studies to tie in with the growing interest in the EU to expand public procurement of innovation creation (Nyiri et al. 2007; Vinnova 2007).

Second, the research question of this study deserves further attention because our single case study does not provide an exhaustive set of constraints. Covering a variety of empirical fields, such studies can uncover novel institutional constraints as well as confirm known constraints in IT innovation creation in heterogeneous inter-organisational collectives. Moreover, our interview-based method has limited depth in uncovering situated innovation practices; studies with alternative methods may capture more richly situated institutional constraints.

Finally, it was apparent in the studied case that innovators were searching for ways to overcome the institutional constraints of *procurement boundary spanning, operation boundary spanning,* and *procurement rationales.* Given this, and the range of institutional constraints that affected innovation efforts, our study implies that institutional entrepreneurship in the context of IT innovation collectives is relevant. Future research on this can be well-received, considering that institutional entrepreneurship in inter-organisational fields has not been given much research attention (Hargrave & Van de Ven 2006). On a related note, we believe user-centered design targeting both customers/sponsors and end-users inherently addresses some of the constraints. The constraints of *procurement rationales* and *market-driven development* imply that a market-needs driven process is attractive, to comply with rather than overcome those constraints. Boundary spanning constraints imply that inclusion of actors representing different sides of boundaries is attractive. In our case they were represented on the supply-side; however the difficulty of overcoming those constraints seemed to make it not a priority to include demand-side actors across boundaries.

8   Acknowledgement

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10 Appendix: Procurement rationales

10.1 Need satisfaction for private consumers

As the public sector restricted its purchases to bare necessities, technology providers were hoping for a growing private consumer market for higher-end applications. Cognitive stimulus tools and high-end hearing aids already had a significant consumer market, while applications such as security alarms were dominated by the public sector market. The consumer market had a procurement rationale of need satisfaction and affordability.

"Society will provide a low base level and the individual will have to pay for what one wants more than that." (Supplier of home alarm components)

"For ten years, the private market has been discussed… One has a long tradition of it being society's responsibility to care for elderly. Another reason is that it's complicated to sell alarms to private persons because… Who should turn out for the alarm?" (Supplier of security alarm applications)

Many elderly could not afford technology applications, so technology providers were expecting purchases to be done by relatives of elderly.

"We have a group of citizens with low pensions… that will not be able to buy these products unless we do it for them." (Municipal home healthcare)

"The target group that could be interesting is children to elderly who want to buy security for mummy." (Municipal housing)

At the same time, a growing portion of elderly had spending power. Some consumers even purchased lower-end applications, eligible for public funding, in order to avoid the hassle of going through a needs evaluation by the public sector.

"This reasonably wealthy generation born in the 40's can afford to buy convenience products." (Supplier of tracking and sensor components)

"There are many people who don't bother to make things difficult and appeal decisions about [hearing] aids, but instead buy this themselves." (Supplier of home alarm components)

Consumers that purchased higher-end applications had to bear the entire cost. Arguably, it would be more fair if the cost of basic applications were given as subsidy for consumer purchases of higher-end versions. The increased affordability could stimulate innovation.

"Basic cost subsidy would make this market completely different to work with, more fun. Many more new products would be developed." (Supplier of hearing aid applications)

One generic idea in the consortium, to increase affordability, was to alter the dominant architectures of technology applications so that they would become multi-functional. For example, extending home alarms with security alarm functionality.

10.2 Investment payback for public housing

One potential channel to the consumer market was housing providers as distributors of technology applications. The housing provider in the consortium was investigating this scenario which meant they would purchase applications and lease them to tenants, like they optionally leased washing machines etc. The leasing scheme implied that the housing provider avoided short-lived applications that would not generate break-even revenues. Hence, public housing providers had a procurement rationale of investment payback.

"We redo any apartments, as long as the municipality pays for the adaptation. When the municipality says, no you can't get a door-closer because you are not sick enough, then the individual has to perhaps purchase these things. That could be via an optional choice system; one calls us and says that I need a hearing telecoil… and then we raise the rent." (Municipal housing)

"The latest we have pulled in, that is broadband in our buildings. It is added as a small cost onto the rent to be covered up during the depreciation period." (Municipal housing)

In addition, related to investment cost, the procurement rationale of public housing required that technology applications should not introduce a maintenance burden for the housing provider (e.g. due to poor integration).

There was sound scepticism against public housing providers becoming suppliers of technology applications; instead their natural role was seen as providing infrastructure such as wired networks. Their role was also contingent on political directives about how much responsibility to assume for elderly tenants.

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