December 2005

A Multi-Perspective Framework for System Design: Measuring Price of Convenience Dynamism in End-User Encounters with Innovation

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18th Bled eConference

eIntegration in Action

Bled, Slovenia, June 6 - 8, 2005

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Abstract

The paper describes a multi-perspective approach to measuring dynamics of end-user encounters with innovative artefacts and services which fall into the class broadly described as pervasive Information Systems and which includes m-commerce systems and devices. This working framework is based on the "Model of User Acceptability and Product Uptake" which, in turn, is drawn from the "Price of Convenience (PoC)" model (Ng-Kruelle, Swatman, Rebne and Hampe, 2002c). We model the framework as consisting of multiple system actors with a variety of influence, interests and functionalities.

1. Introduction

In order to ensure acceptance and uptake of new technology such as wireless applications and accompanying services, one should consider a variety of issues, ranging from the purely technical to those of the business and social sciences, including, for example, marketing and psychology. Social, cultural and psychological factors related to the product and services not only influence the success of ICT innovations such as mobile and wireless applications, and but also affect the adoption patterns of these applications. To understand how end-user decisions may vary according to different inputs, it becomes necessary to study them in the *context* in which adoption/uptake behaviour occurs.

In this paper, we will first establish a foundation by presenting our research framework: the "Price of Convenience" (Ng-Kruelle et al., 2002c) which offers a basis for understanding the "socially pervasive ICT service/artefact" adoption process.

We briefly describe our research strategy and then move to the primary objective of this paper: to operationalize the Price of Convenience model and to develop a research plan for exploring and analysing contextually based decision making by individuals considering innovation uptake. Finally, we describe in some detail how the operationalized research model might be used in practice.

2. The Price of Convenience Framework

The development path which has led to the Price of Convenience (PoC) model has been recorded in a number of publications (Ng-Kruelle, Rebne, Swatman and Hampe, 2003a, Ng-Kruelle, Swatman, Rebne and Hampe, 2002d, Ng-Kruelle, Swatman, Rebne and Hampe, 2002b, Ng-Kruelle, Swatman, Rebne and Hampe, 2002a, Ng-Kruelle, Swatman, Rebne and Hampe, 2003b, Rebne, Ng-Kruelle, Swatman and Hampe, 2002, Rebne, Ng-Kruelle, Swatman and Hampe, 2003). In the following section, we briefly explain and describe the PoC model (illustrated in Figure 1). For a more detailed justification of/rationale for the decisions which were made in the construction of the model, including, most notably:

- context-sensitivity and culture (Ng-Kruelle et al., 2002a)
- Weberian behavioural archetypes (Rebne et al., 2002)
- Relationship to the work of Rogers and to the Technology Adoption Model (TAM) and its variants (Ng-Kruelle et al., 2002b)

we refer you to the earlier work cited above.

The unit of study for our programme of research is the individual potential end-user of the service or artefact. We have argued that the attitude of the potential user to the innovative artefact influences the potential user's behaviour. In developing Price of Convenience – as its name (we hope) indicates and as the diagrammatic illustration of the model explicitly indicates – we have not attempted to be all encompassing in our consideration of end-user attitude, but rather to focus particularly on the triad:

- perception of individual convenience gained
- perception of individual privacy "lost"
- perception of security (in the sense of societal security, national security) gained/lost as a consequence of service/artefact adoption. Nor do we attempt to argue that user attitude (particularly, in this restricted sense of "attitude") determines user behaviour.

From a review of literature relating to the adoption of wireless information and communication technology (ICT), we identified various external issues, both utilitarian and non-utilitarian to be deeply entwined in the relationship between three entities: the end-user, the product and the system in which adoption/uptake occurs.

- The **Subject**: End user adoption behaviour "likelihood" and acceptability attitude through the formulation of the individual's *price of convenience* – the balancing of loss of privacy or feeling of security in a societal context as result of adoption against personal convenience and/or perceived gain in sense of security. Aspects which may be considered here include: lifestyle, motivation, knowledge, innovativeness, involvement, demographics, experience, trust, values and attitudes.
- The **System**: How context emerges and influences end user behaviour and attitude. The context is a tapestry of influences from different "system actors" which shape culture, subjective norms and provide exposure. The emergent context becomes input for transformation of the **Subject** behaviour and attitude in relation to the **Object/Product**.
- The **Object/Product**: The characteristics and the pervasiveness of wireless applications leading to perceived (**Subject**-perspective) usefulness/convenience against loss of privacy and security.

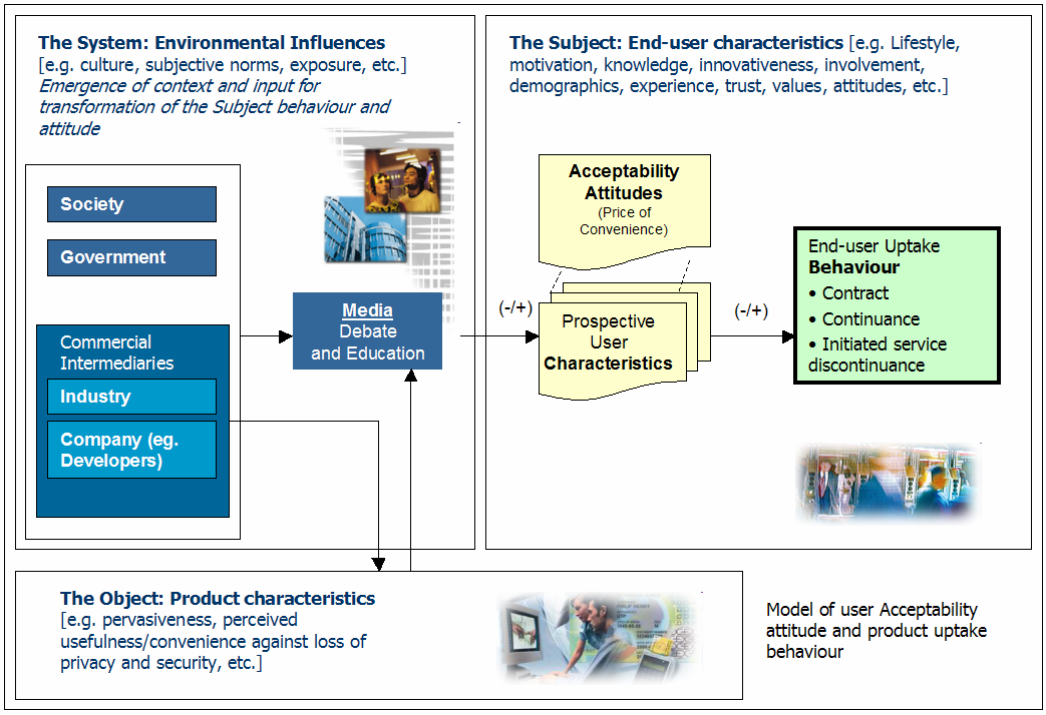

Figure 1: PoC - Model of User Acceptability and Product Uptake

Figure 1 illustrates an expanded Price of Convenience analytic frame (See for example (Ng-Kruelle et al., 2002d) now labelled as "PoC - Model of User Acceptability and Product Uptake" incorporating the entities above. The difference between this version and that of the earlier provisional model it is richer descriptive features as more elements of interests to the research (e.g. here the object – denoting product characteristics highlight) are added.

When we first developed the Price of Convenience model, we sought to provide a conceptual framework for understanding the interactions of the main social actors and the dynamics of the development of the context – and, perhaps, of the artefact or service – on end-user attitude, especially the perceived balance of convenience, privacy and security.

A useful model must be supportive of the interpretation of information dynamics and the derivation of measures of both the extent of and the reason for changes. According to Whitman et al. (2001) (Whitman, Ramachandran and Ketkar, 2001) the three dimensions of such "living" models are: scope, enactment, and the dynamicity. Scope refers to the "pervasiveness of the model throughout the enterprise" (in our case, through the system which forms the context of innovation diffusion). Enactment refers to the "level in which the model drives and is driven by the system", and dynamicity refers to the ability of the enterprise (in our case the system which forms the context of the innovation diffusion – together with any system which exists to generate change to the service or artefact in response to such contextual change) to "respond to both permanent and temporary process changes to the system".

This paper describes a framework for the measurement of the dynamics of the attitudes (in the restricted sense we have mentioned) of potential end-users in encounter with product innovation. We argue that an understanding of the dynamics of end-user attitude to the innovation (when aggregated effectively – a matter which we have discussed in detail in (Rebne et al., 2002, Rebne et al., 2003, Ng-Kruelle et al., 2002b)) forms a valuable input to the decision making processes of all *"systems clients"*. A *system client* can be a service provider (the distributor of the innovative service or artefact – or a competitor thereof), government, the service sector (industry), society-at-large (including individuals and special interest groups) both individually and as an aggregate and the media (See (Ng-Kruelle et al., 2002d)).

The main goal of our work, therefore, is to extract relevant information from the "dynamic" interactions of various system actors, and to identify possible "interventions" which may be made, by the "systems client" actor, in the system. The goal, therefore, is to achieve some level of probabilistic prediction of the behaviour of the entire innovation diffusion system.

3. Theoretic Fundamentals

When a model is developed to represent the reality, like the reality, it needs to display characteristics of flexibility in response to change – both internally and externally induced. It is clear that the PoC model reflects a dynamic system which might conceivably be interpreted – through one or more independent "snapshot" images; or explicitly as a dynamic, most conveniently through snapshots considered as a series of time slices, or through coherent periods of in-context observation.

We have argued in earlier work (Ng-Kruelle et al., 2003b) that, while there is certainly information contained within snapshot images, there is also valuable information contained within the dynamic itself – in the trends of attitude formation, in the often diffuse secondary and tertiary effects of interventions in the context. It is clear that the effects of intervention alternatives available to any actor within the system are difficult to predict with any precision – indeed we are unconvinced by arguments that static measures ("before and after" images) could be interpreted adequately to generate persuasive cause and effect conclusions. Our conception, therefore, is of a dynamically evolving system characterised by the interactions and inter-relationships of the otherwise independent actors which the context contains.

We may, now, turn our attention to the actors in the context – the organisation attempting to diffuse the innovation; their competitors (defined in the broadest possible sense); civil action groups (eg privacy advocates); governments (seeking to regulate, to tax, to be re-elected); and so on. Each Actor, while affected by the actions of the others, has, itself, considerable independence of action. Each Actor might reasonably be expected to participate within the context in ways which reflect its perceived self-interest (though, of course, its self interest is not limited to optimising this specific context – clearly a loss to the benefit of a cooperating Actor here could lead to a greater gain elsewhere). Nonetheless, the Actors do not perceive/interpret the context identically.

3.1 Perspectives Defined

Each Actor views the context from one or more perspectives. In considering these perspectives, we face a fundamental choice. In information systems, research can be considered either to be "hard" (objectivist-positivist) or to be "soft" subjectivist-interpretive. According to Checkland (1983; p. 41) the difference depends upon the underlying assumptions about the "nature and location of what are thought of as systems" (Checkland and Holwell, 1998). Hard systems thinking assumes that a system exists in some objective sense and can be moulded to achieve specific goals; while soft systems thinking sees the world as complex and problematic and subject to many internally consistent but mutually incompatible interpretations – none of which can be said to be "objectively more valid" than any other.

"Perspective" thus, is a term that can be used in multiple different ways. In the requirements engineering literature, where underlying thinking is typically positivist, the term *viewpoint* is used synonymously with *perspective*, to mean a (typically incomplete) representation of a system – but one which, at least in principle, may be composed with other correct (but probably incomplete) viewpoints to form a complete description (Sommerville, 2000). The challenge, in hard systems thinking, is not *whether* multiple viewpoints may be composed but, rather, *how* to achieve such a composition.

In this paper, however, we adopt a subjectivist-relativist position, arguing that all Actors – whether organisational or individual – act (strictly, in the case of organisational Actors, *appear* to act) on the basis of their perception(s) of the context and that these perceptions/interpretations are a consequence of what Checkland (Checkland and Scholes, 1989, Checkland and Holwell, 1998) calls their *Weltanschaungen* – their perspective(s) on the system – and these actions are, in similar fashion, interpreted by other actors in the system. Not only does the system serves as a platform where interaction occurs and knowledge is exchanged and distributed between the Actors, each Actor is also involved in the process of initiating and responding to change to and evolution of the system through (possibly unconscious) "negotiation" and subjective interpretation.

Our Price of Convenience model therefore owes something both to Checkland's Soft Systems Methodology in the sense that it represents a human activity system "relevant to" (as opposed to "of") the context under investigation, and to the work of, Morgan, (see, for example, (Morgan, 1997) in which ideas from a stream of earlier research are collected and a number of images of organisations are illustrated). The "metaphors and ideas through which we "see" and "read" situations influence how we act. Managers who see organizations in a mechanistic way have a tendency to try and "mechanize." Those dominated by a cultural lens tend to act in a way that shapes and reshapes culture. Favoured metaphors tend to trap us in specific modes of acting" (p. 350).

We see, in Price of Convenience, therefore, a conceptual framework for our multi-perspective investigation of the diffusion of socially pervasive ICT innovation.

4. Dynamics and Interfaces

The focus of our interest is innovation – the introduction and reaction to its introduction. *Innovation* is generally recognised by scholars to be an interactive and evolving, rather than a one-off, process. This leads researchers to think in terms of *systems* (Lundvall, 1999), and of a web of relationships rather than of some individual element/incident in isolation. Empirical studies have shown that this interactive evolutionary process occurs as "feedback from the market, such as knowledge inputs from users," that "interact with knowledge creation and entrepreneurial initiatives on the supply sides" (p. 62) (Lundvall, 1999). The complexity of the system is significant, incorporating aspects such as the web of interactions of system actors themselves, as illustrated in the PoC model, and contextually-based decision making (Ng-Kruelle et al., 2002d). Other contextual issues of adoption are variables such as (Rogers, 1995): the type of innovation-decision, communication channels, nature of the social system and the extent of change agents' promotion efforts – and, indeed, the inherent influence of the change agent him/her/itself.

The adoption process of an innovation has never been shown be predictable in a precise sense – indeed, it has resisted clear cut explanation at a cause and effect level. The process differs from context to context, and is continuously reinvented and refined with different users (Iivari and Janson, 2001, Orlikowski, 1992, Rogers, 1995).

Innovations based on underlying technologies which are themselves still undergoing changes, for example, are (unsurprisingly) found to be particularly "unstable". Currently, socially pervasive ICT innovations – mobile commerce, location-sensitive and location-based services and artefacts – which are the focus of our interest clearly fall into this category. As described by (Orlikowski, 1992) the technologies are "under continuous (re)development, social (re)construction, and IT itself tends to have high interpretive flexibility".

The evolving nature of such an innovation implies that its adoption pattern is not characterizeable as a one-time decision (that is, a decision either to "deploy" or "not to deploy"), but is rather a "continuous process of living with the evolving innovation" (Iivari and Janson, 2001). The studies have shown that user experience and needs that are related to new technology are not static, but continues to co-evolve with the new technology.

Two main theoretical and analytical concepts illustrate the interfaces of adoption of an evolving innovation:

- "Interactive learning" between the producer and the user (Lundvall, 1999); an iterative process that is found to be crucial to successful implementation of an innovation resulting from a well received product - i.e. adoption. This includes qualitative tools for identifying user needs and new product opportunities; such as Leonard-Barton's *emphatic design* that is based on actual observed user behaviour conducted through direct interaction between parties with "deep understanding of the firm's technological capabilities and potential users", and then drawing upon existing technological capabilities that can in a way be used for future products (Leonard-Barton and Kraus, 1985); the *lead user approach* which is designed to collect information from the leading edge – the innovators – of a company's target market, with the assumptions that they are representative of future adopters (von Hippel, 1986). Other similar approaches that emphasis the importance of user involvement and systems interactions (i.e. networking) are such as the economics of innovation (Freeman, 1991), sociology of technology - in particular the actor-network theory (Latour, 1987) and organisation theory (Powell, 1990).

- Activity-theoretic (AT) perspective on adoption (Bannon, 1997); used in studying "work practices" by focusing on different aspects of activity. Originated from the discipline of psychology, AT has recently found a loyal following in the IS community, where it has taken the form of a more general approach for understanding the dynamics of activities in socially and organisationally oriented problem domains (Bannon, 1997). Examples of AT's application may be found in the literature on computer supported cooperative work (CSCW) and human-computer interaction (HCI), where AT has been used as a mean for integrating theories and concepts(Redmiles, 2002, Miettinen and Hasu, 2002, Barthelmess and Anderson, 2002).

One of the shortcomings of most of the approaches above, including Economics of Innovation and Actor Network theory is the difficulty in conceptually deriving the co-evolution of the innovation, the user and the system. Economics of Innovation, for example, often focuses on formal relationships, neglecting hidden casual interactions. Similarly criticisms can be made of the application of actor network theory, where it has tended to ignore the cultural resources and of the learning component in the system (Miettinen and Hasu, 2002).

AT, however, contributes to the class of problems which might also be addressed through application of Soft Systems Methodology (Checkland, 1981, Checkland and Holwell, 1988, Checkland and Scholes, 1989) or Stakeholder Analysis (Vidgen, 1997). AT assists in highlighting perspectives that are different from the conventional "production oriented" view, and focuses instead on the process view.

The *context* of social norms surrounding mobile communication and technology is dynamic. Constant changes of attitude and usage behaviour occur with practical experience of artefacts and services and through contact with other users, both within and across communities. As evident in a 2001 report published by Context-Based Research Group on wireless device usage among people in nine cities: Beijing, Hong Kong, Tokyo, Stockholm, Paris, London, New York, Los Angeles and San Francisco: an identical product will have multiple usage identities, not only across communities, but also within a community of users with different background (Blinkoff, 2001). Thus, understanding how context emerges and evolves is important to a researcher investigating how people react to situations[1].

5. Research Plan

We now develop the research plan shown in Figure 2 as the first step in deriving systematic analysis of the dynamics of contextual change and reaction to product innovation. Figure 2 illustrates an operationlization of the conceptual idea shown in Figure 1. There are three main areas of potential study: client, context and measurement.

In *client*, drawn out of *context*, we define the "actor" of which to focus the study, which can be chosen arbitrarily from one of the system actors in Figure 1. By identifying the *client*, we will then be able to focus on the context in relation to the *client's* interest. The activity undertaken by the *client* would be to understand the context and thereafter introduce interventions. Interventions may take the form of product related issues or the introduction of new regulations or guidelines.

1 The study of "contexualization" has been applied to multiple areas in various disciplines: complex problem solving activities, knowledge creation, creative work, education, society, health and even in religion.

The *context*, is in essence, a compressed Figure 1. This entity forms the source and determine the type of inputs to be extracted for study, particularly that of "marketing/sales" nature. This form of input is crucial, as later analysis (which may primarily take the form of content analysis) will be based upon various market/product data to identify market scenario (product, technology, etc.) that forms part of the context. These, when studied longitudinally, will allow us to derive and analyse clusters of "new ideas".

In *measurement* we extract and analyse result of content analyses, identifying dynamics and changes to the system for possible prediction. This will also include identification of "interruptions" in trends and the degree of this "disturbance". The feedback, as result of *measurement*, would be input for the next learning cycle, as knowledge for the *client*.

The numbers in Figure 3 indicates the order of information flow (input). The identification of *client* [no.1] determines the *context* [no.2] from which information will be extracted for analysis and *measurements* [no.3], resulting as feedbacks [no.4] to the *client*. The knowledge accrued at this point will be translated into actions in forms of interventions [no.5] from the *client* to the *context*. These interventions, depending on the role of the client, can be further categorised into three different types proposed in Figure 4.

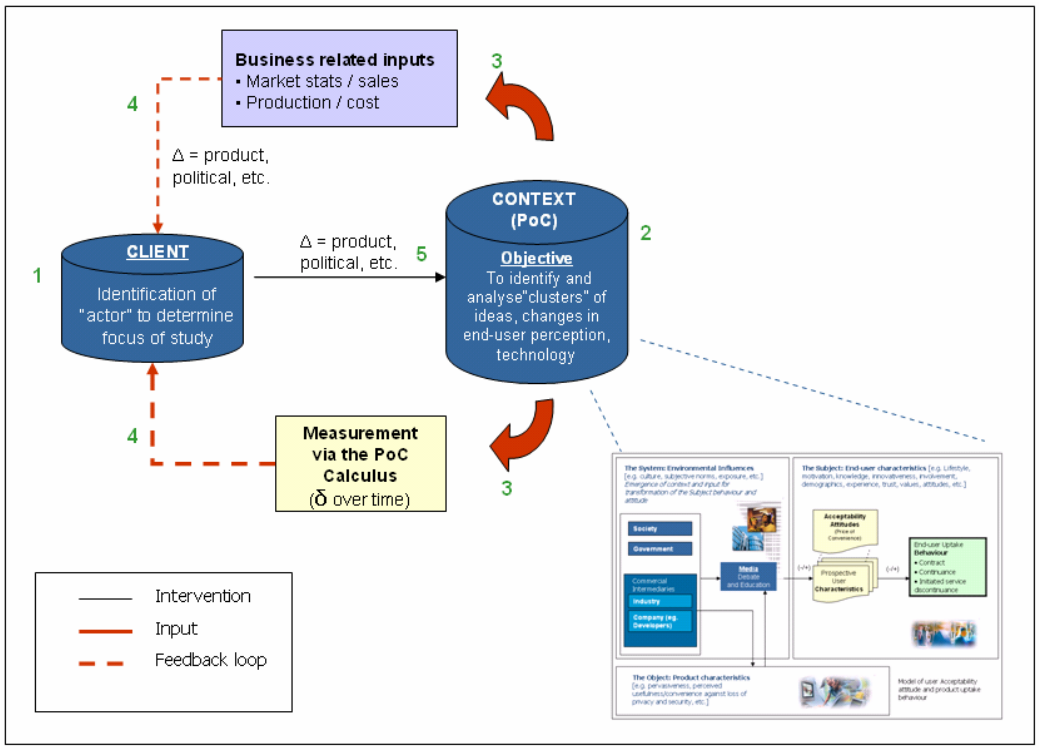

Figure 2: Exploring contextual based-decision making in innovation uptake

5.1 Designing the System for Analysing Dynamics

The process of defining and using this model will help to address the following questions (Ng-Kruelle et al., 2003a),(Ng-Kruelle et al., 2002d):

(a) What are the components in the system design and which features define each component?

(b) What interfaces (i.e., physical and non-physical inputs and outputs) exist to and between these elements?

(c) How can the dynamics of each component and the emergent systems dynamics be characterised and measured?

(d) How can these dynamics be used to predict, evaluate, or even to improve and control the overall outcome of the system?

The research model will provide a methodology for analysing dynamism of contextual change and reaction to product innovation. Guided by "traditional" approach of enterprise information system modelling, we will operationalize the model as consisting of multiple system actors with different influences, interests and functionalities. We will apply and extend the conventional enterprise system process modelling design to that of socially connected system. The methodology will provide us the possibility of identifying components in the system design and features that define the components, the interfaces between the components, a method of providing representational formalisation while meeting "performance criteria" (e.g. positive outcomes such as profit, increased mobility, etc.).

The following research model is proposed, comprising of four modules: (1) Subject-Object Interface (the encounter), (2) Subject characteristics (the identification of client), (3) mediating factors (the enablers-disablers), and (5) measurement (see Figure 3).

In the *subject-object interface (product encounter) module*, we define the parameters affecting the perception of the interface environment through the client. Such parameters include interaction modes and interaction intensity where the "encounter" takes place. Examples of encounter are such as human interaction, either face-to-face or decoupled by a contact technology such as a mobile phone or via the fixed internet and human-computer interaction. It has the role of identifying *who* is performing *what* actions during the interface and the complexity of the product encounter. Related to this is the system design, both physical and non-physical parameters concerning the actual structure and setup of the wireless system are defined. Examples for such parameters include routing and the degree of control in the delivery process. Routing refers to the pathways, predefined to a certain degree that would determine the degree of freedom customers have in developing their own "experience". The degree of control refers to the amount of intervention a third party, for example, the management would have over job and process design, service encounter, and other dimensions. Hence, the degree of control is tightly related to routing. The system design determines *how* and *where* the subject-object interface takes place and is conducted.

The *subject characteristics* (*client identification) module* serves as a decision input in two ways. First, client profile information is collected. Second, the segmentation of the wireless service type is derived. Data collected in this module includes client requirements, expectations and perceptions, as well as other options and alternatives of delivery available.

The *mediating factors (enabler-disabler) module* reflects the social-technological components involved in the encounter. It is necessary to define the enabler's module in a wider sense than just the technological one. In our view, it has to comprise any kind of innovation or further development of new data communication standards for digital transactions as such developments could contribute towards customer satisfaction through improving the service level. Also, are other legal, social or economic issues pertaining to the product that would either push or break the innovation.

Lastly, in the *measurement module* we include a feedback mechanism consisting of various traditional and non-traditional measurements of the system. The purpose of this module is to refine the definition of "contextual dynamics" in wireless applications as well as "quality of service" as defined by the end-users.

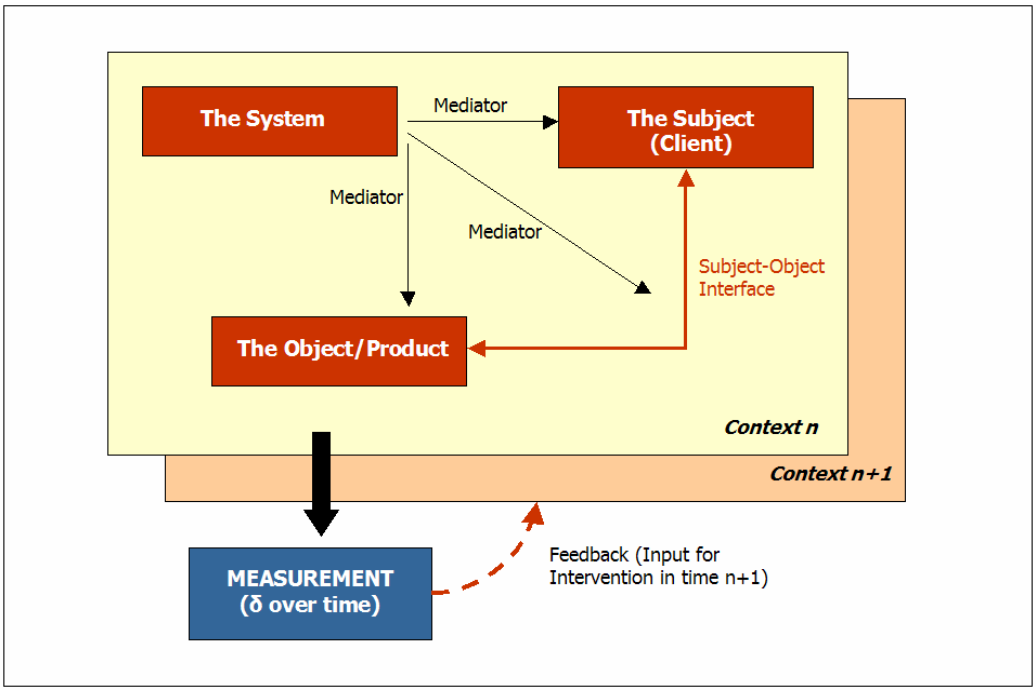

Figure 3: Research Model

Interactions between the PoC System Modules

In Figure 3 above, various interactions exist between the PoC system modules. There are basically three types of links within the model: mediating, interface and feedback/input. The *system* where emergence of contexts occurs as input for transformation (intervention) for the *subject*, has a mediating role – both enabling and disabling in nature. It influences the *subject*, the *object* and the *subject-object interface*. The data collected from the *system* module helps to further refine different customer segments within the system, which will be designed under the influence of the mediating factors, here defined as any technologies, technological innovations, and other external issues such as legal and social, applicable to the system.

The second type of link is the interface between *subject* and *object*. It provides input pertaining to the subject such as client's requirements, expectations, and perceptions. This information is mapped or translated into measures and parts of measures used for the feedback mechanisms.

The third type of link is the continuous information flow or feedback between "contexts". The context to be studied will be identified in time *n* and changing dynamics that influences this dimension documented, changes over time (*measurement*) as input for future reference and as input for interventions.

The knowledge accrued at this point will be translated into actions in forms of interventions from the *client* to the *context*. These interventions, depending on the role of the client, we proposed as being both direct and indirect influence, or as reaction to the inputs.

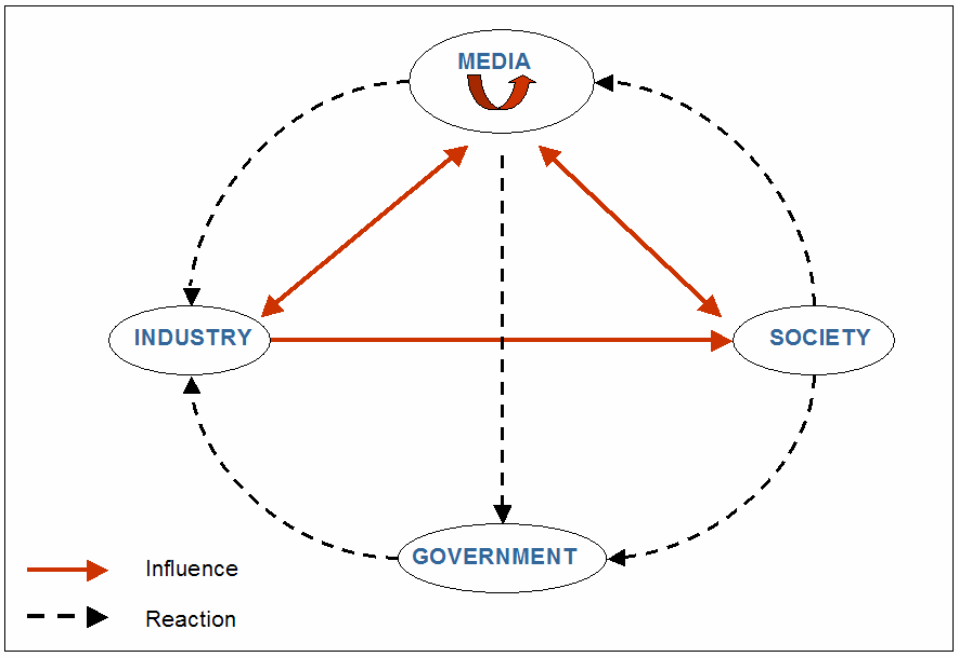

Figure 4: Interactions between clients/actors as influences and reactions to system inputs

The form of interventions, as result of interactions, is a constant chain of actions and reactions. Figure 4 illustrates the relationship of this course as in the case of a new technological innovation. The *industry* (and very rarely the *government*) are the initiators of changes to the system. Often at this stage, technology advances are the drivers of change. The *media* accompanies this process in two different ways. In the early phase of innovation development, it attempts at predicting trends, resulting in either over or mis-hyping. In the later stage, the *media* will begin to reflect on the development of the innovation. As a result, public opinion are influenced, and sometimes, enough to the extent of inducing legislative changes. In addition, the *media* influences itself extensively. For example: an event released by the public media may be picked up by another *media* entity leading to similar – merging opinion or varied news – dividing camps of debates.

The *government* reacts to the *media* (less so to the *industry* directly), and tends to follow current national/public need once the technology is developed. Thus the *government* is always seen as a lagging actor in the system. The *society* (such as consumer pressure groups) is mainly reactive, using the *media* and then later, the *government,* but rarely directly to the *industry*, to induce behavioural change to the systems through legislations.

Examples of this interaction for socially pervasive computing are:

- In mobile commerce, SMS (Short Message Service) was purely a technological phenomenon. It was a basic service within GSM (Global System for Mobile communications) and for a long time adoption and usage rate remain low until the *industry* and *media* brought it to what today became the most intensively used mobile service. With the help of the *media*, *society* (pressure groups) kept the price hike to the minimum. When called for, the *government* reacted to cases of misuse such as spam or misuse of premium SMS. *Industry* reacted to the *society* (market) by extending the service to fixed network and by further introducing MMS (Multimedia Messaging) which is then over-hyped by the *media*, but nevertheless used by the industry as the main channel to reach out to the *society* (end users).

- Services based on "call-by-call" and "premium service numbers" which helped to realise de-monopolisation and deregulation of the market on the one hand but on the other hand clearly brought misuse leading to introduction of new consumer protection legislations.
- Another interesting phenomenon currently under-explored are location based services (LBS). Mandatory in the USA for E-911 services and in Europe for E-112 services, mobile handsets are equipped with built-in GPS (Global Positioning System) receiver to enable the systems. However, tracking and tracing of individuals are serious issues for *society* and will result in further introduction of legislations by the *government* for the protection of individual privacy and yet leaving enough room for personal and national security.
- Finally, is the strong technological drive in the RFID (Radio Frequency Identity) deployment along the supply chain. The move by Europe's three largest retailers in the *industry*: Metro, Tesco and Carrefour indicated the pervasiveness of this issue and technology (heise.de, 2004), but *media* and *focus groups* are already forming strong resistance. As in the case of the "Metro Future Store" (See: http://www.future-store.org/), nothing more than a showcase so far, but was forced to redesign under the influence of *pressure group* via *media* (Kamp, 2004).

When arranged in a tabular format, we see it resembling the following types of interactions in form of change and interventions:

System Actor	Examples of possible intervention / change to the		
	System	Context	Relationship to other actors
Company/ Industry	o New product launch; o Product modifications; o Changes to terms and conditions, etc	o Meditating the context; o Moderating constraints; o Interruptions, etc.	o Reactions to legislations, press releases, pressure groups, etc.
Government	o Introduction of new legislations, o Alterations to existing legislative framework, etc.	o Meditating the context; o Moderating constraints; o Interruptions, etc.	o New product launch; o Product modifications; o Changes to terms and conditions; o Press releases; o Argumentative appearances, etc.
Society (e.g. Consumer pressure groups)	o Emergence of "new" culture, values, norms, etc.	o Meditating the context; o Moderating constraints; o Interruptions, etc.	o Responses to new product launch, press releases, legislations, etc.
Media	o Press releases; o News stories; o Argumentative appearances as response to other system inputs, etc.	o Meditating the context; o Moderating constraints; o Interruptions, etc.	o Surrogate for public opinion (or the voice of the government); o Responding to "issues" of discussions, etc.

Figure 5: Possible interventions on the system, context and relationships with other actors

6. Conclusions: Summary and Outlook

Modelling PoC systems will assist us in process identification (interfaces, interactions), measurement (system dynamics, interruptions, disturbances) and possibly control (client over the system, vice-verse).

The research model provides a methodology for developing and implementing a "product" in a structured manner. By modelling PoC system through a series of modules provides a method for process identification (interfaces and interactions), measurement (of dynamics and level of satisfaction) and control (of end-user over the system, vice-verse).

Further work will require identification and validation through anecdotal and empirical research factors influencing the design and operation of such a system. For this purpose, we will perform longitudinal analysis of textual data - mapping and mining the evolution of concepts over time in both small and large text collections. We plan to make use of Leximancer (Refer to website: http://www.leximancer.com/), a Bayesian-based content analysis software system to provide some support in this process. To this end, we are currently developing a mechanism to enhance the visualisation of the evolution of concepts/concept relationships.

The scope of our initial study is socially pervasive ICT systems and artefacts, for use by private end-users (i.e. business-to-consumer services or government-to-consumer services, consumer-to-consumer). The study will be divided into two phases. The first phase will be a pilot study using Leximancer for empirical operation and validation of the model. Data collected here will be limited to a sample of reports published within the practitioner and public media over the period of 1999-2002. This limits, fairly effectively, the readership demographic to professionals within a single geographic/linguistic market to ensure a controlled cultural context. The second phase, an extensive historical public media content analysis will be undertaken, interpreted within the PoC framework.

In subsequent work, we intend to consider the explanatory power of alternative theories of attitude formation; extend the domain of study from the private to the business use of pervasive ICT services and innovations (and to investigate cross-contamination of attitude and behaviour across private and business use); and to conduct empirical cross-cultural studies.

In conclusion, we expect this work to significantly contribute to our knowledge of socially pervasive computing. While theoretically founded, we hope the results to be widely applicable in practice.

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