Ambient Intelligence and the Role of Education of Future Managers

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Ambient Intelligence (AmI) is a relatively new concept that anticipates a shift in the usage of information technology (IT) from desk computers to various information devices and substitution of the prevailing technological aspects of computing and IT by intelligent interfaces of a particular environment. It is obvious that AmI, apart from other areas, is also related to managers and their workplace. The Faculty of Informatics and Management (FIM) at the University of Hradec Kralove educates future managers with strong technological orientation. That is why FIM is interested in, and has a great opportunity to contribute to the development and realisation of AmI. At FIM, all students enrolled for particular study programmes to obtain necessary knowledge from a related field (e.g. management, economics, quantitative methods or IT). The fundamental idea of all conducted activities is that future managers are present students. These students with a given specialisation have the possibility to both pose requirements to AmI and also cooperate by creation of single solutions (e.g. intelligent agents or information systems interfaces).

Keywords ambient intelligence; manager; education; systems thinking

1. Introduction

Ambient Intelligence (AmI) is a relatively new concept that provides a vision of an information society of the future, where user-friendliness, effective and distributed support of services, reinforcement of the sources of user's resources, and support for interactive work are strongly emphasised. AmI can be investigated from several perspectives (e.g. technological, social or a political one). AmI represents a complex system, where the managers' workplace is only a small part of the whole. Here, we can see the opportunity for systems thinking to help. AmI can be considered as a concept system, which can be analyzed only by the utilisation of specific abilities and skills related to systems approach for problem solving and decision making [1]. Current education can not be realized on the basis of simple information transfer any more. The younger generation has been growing up surrounded by many technologies and electronic devices that in direct or indirect ways determine requirements on the educational process. It is also desirable to produce "secondary effects" like a students' organization ability, persistence and capability to control him/herself, or correction of his/her own mistakes.

2. Scenarios of AmI

ISTAG report [3] introduces four scenarios of the future development of a current information society. In other words, authors tried to outline the possible development of AmI in daily life and work around 2010. The vision of AmI is a very attractive starting point for future research. Research areas can include intelligence agents, knowledge technologies, mobile communications, portable devices or systems integration. Besides technological issues, these scenarios offer insights that the social and political aspects of AmI will be very important for its development [3]:

- AmI should facilitate human contact.
- AmI should be orientated towards community and cultural enhancement.
- AmI should help to build knowledge and skills for work, better quality of work, citizenship and consumer choice.

- AmI should inspire trust and confidence.
- AmI should be consistent with long term sustainability – personal, societal and environmental and with life-long learning. In essence, the challenge is to create an AmI landscape made up of "convivial technologies" that are easy to live with.
- AmI should be controllable by ordinary people – i.e. the „off-switch" should be within reach: these technologies could very easily acquire an aspect of „them controlling us". The experts involved in constructing the scenarios therefore underlined the essential need that people are given the lead in way that systems, services and interfaces are implemented.

Created scenarios are "Maria – personal ambient communicator", "Dimitrios – connecting people and expressing identities", "Carmen – traffic optimisation" and "Annette and Solomon – social learning by connecting people and creating a community memory". The basic differences among all four scenarios can be seen in Figure 1.

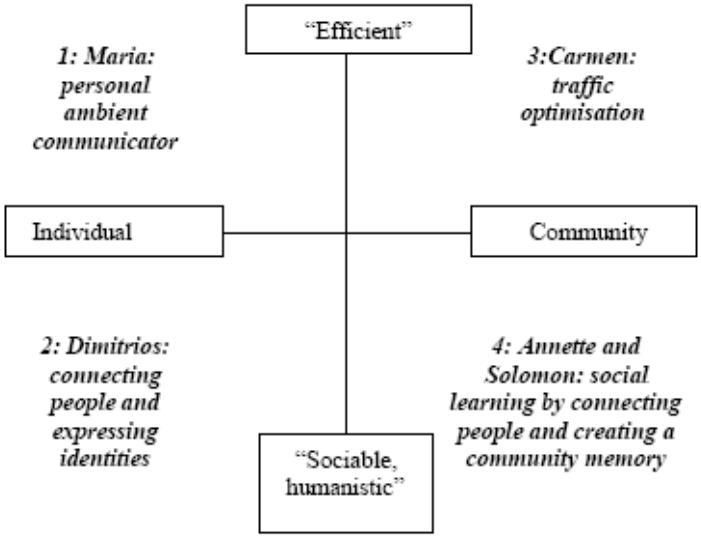

Fig. 1 Goals and actors of AmI scenarios [3].

Four quadrants represent four alternative development paths of AmI that scenarios' authors offer to consideration. There is a brief description of the required changes, basic barriers of realization and lead markets, where solutions can be implemented [3]:

- Maria is a scenario, where the technological and socioeconomic changes are based on existing approaches. No large changes in behaviour are assumed. The key barriers appear to be the establishment of interoperating hierarchies of agents. The lead markets for AmI here are business sector demands, which tend to be more efficiency orientated and less price-sensitive.
- Dimitrios scenario offers an alternative mode of the use of personalised ambience. The emphasis is on play and social interaction rather than „efficiency". Lead markets for AmI may emerge first amongst „alternative or youth cultures." The changes in behaviour relate mainly to the willingness to reveal (or disguise) personality on-line. Price could be a barrier to a break through to a mass market.
- Carmen scenario implies major infrastructural developments (i.e. highly developed networks of inter-operating sensor systems and dynamic database management systems). These also represent the basic barriers of realization. Scenario makes significant assumptions about changes in public behaviour such as accepting ride shares and traffic management systems.
- Annette and Solomon scenario is the furthest out in terms of time, because it has high requirements both on technological and socio-economic changes. It implies significant technical developments such as a high „emotional bandwidth" for a shared presence and visualisation technologies, or

breakthroughs in computer supported pedagogic techniques. In addition, the scenario presents a challenging social vision of AmI in the service of a fostering community life through shared interests.

3. Task of systems thinking

It is obvious that people, who will shape AmI landscape, should be able both to pose requirements and cooperate by its creation. There are two reasons, why systems thinking (ST) has the ability to help here and presents itself as an appropriate approach. Firstly, AmI as the problem with a high complexity has several dimensions and their study has to be interlinked. Secondly, technological solutions and their creation belong with their nature to the area of systems engineering, where tools, techniques and methods for work with systems have to be utilized. At the Faculty of Informatics and Management at the University of Hradec Kralove (FIM), ST is taught in two interrelated subjects. Students have to make use of acquired knowledge and apply ST in the study of various problems from a technological and managerial point of view. Here, AmI seems to be the most appropriate area, since future managers can, by analysing this phenomenon, either shape or at least better understand their future workplace.
Obviously, it would be meaningful to create a "managerial scenario" that would describe the future workplace of managers. To be able to do this, students have to have knowledge about a variety of utilizable technologies and approaches. That is why the method used at the FIM is based on students' activities, when they identify systems from a holistic point of view (according to [2]). They describe a system's elements and relations, structure and behaviour of a system, system's attributes or position of a system in different systems classifications. Exploited tools are general systems archetypes, systems dynamic and related simulations, causal loop diagram or stocks and flows diagram (see example in Figure 2 taken and adjusted from ISEE Player). For instance stocks and flows are very interesting building components that create an infrastructure of a system and also represent the basics for feedback loops. There is not feedback without infrastructure (according to [4]). Therefore, students should not use causal loops diagrams without previous knowledge and understanding of a system infrastructure of stocks and flows. Construction of a causal loops diagram at the beginning of a problem analysis leads usually only to the creation of a long list of factors that influence a system, but will not lead to understanding of the problem.

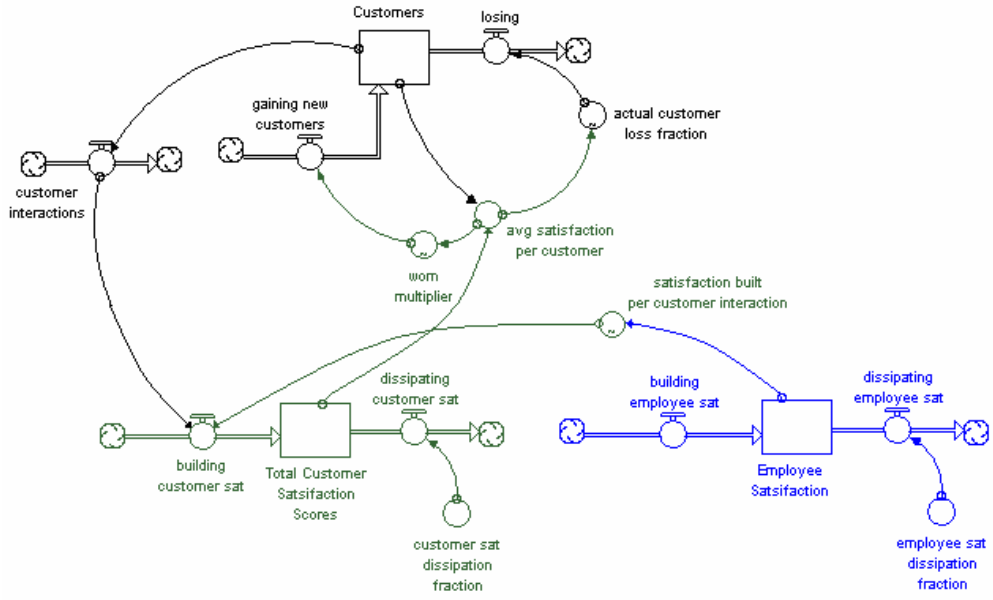

Fig. 2 Stocks and flows diagram used for description of single systems.

Since individual solutions are expected to be created and implemented sooner than the "community" scenarios, students should begin with identification of basic elements and relations and behaviour of a system from the individual managers' point of view (not the group or team one).
Although students probably can not find answers to questions of how to overcome identified barriers of full AmI development and realization, they try to use the provided techniques and tools to outline solutions to similar but easier problems. An example can be seen in Figure 3, where typical resistance to purchase and utilization of ICT is depicted in the left upper part of the figure. Students try to use different points of view (e.g. marketing point of view) and determine presumptions of their arguments (e.g. proper support of ICT to business processes).

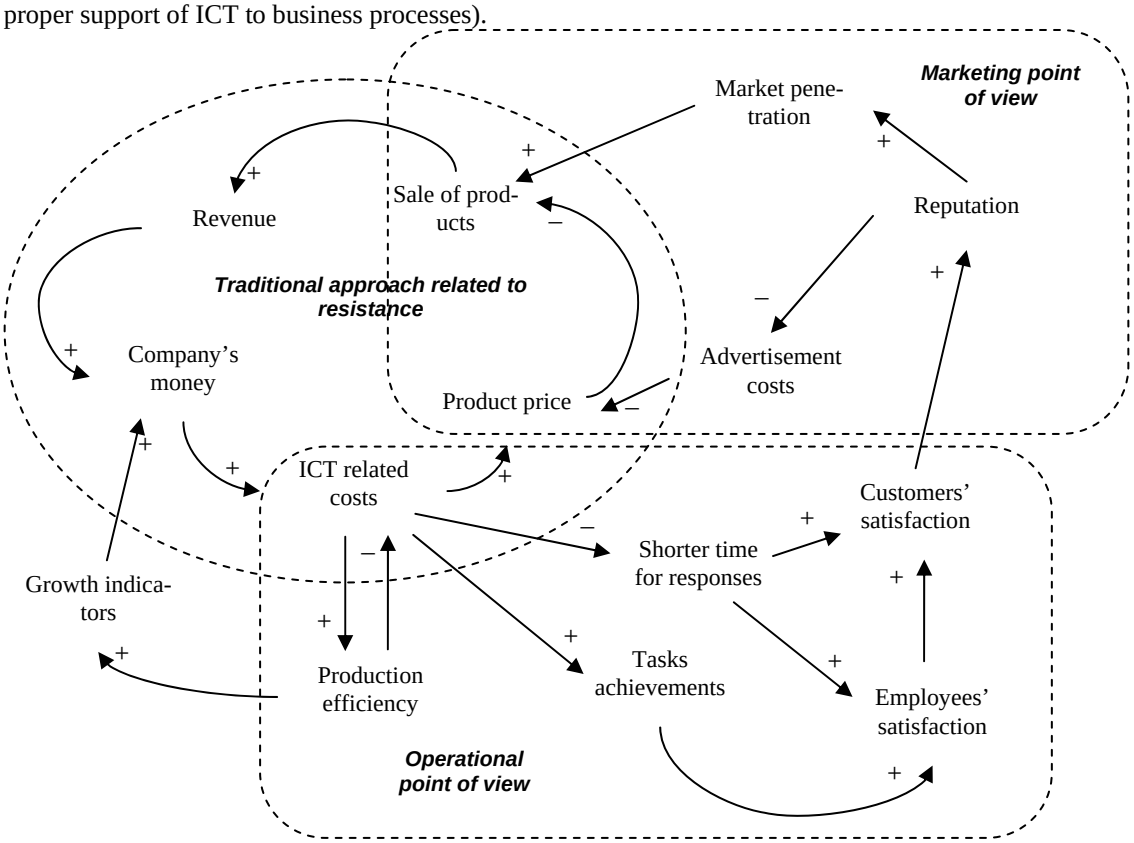

Fig. 3 Example of causal loops diagram.

4. Conclusions

AmI put emphasis on life without senseless barriers of communication and life in general. Our attention is paid to the life of managers at their workplace. ST proved to be an appropriate support for the formation of AmI in the managers' workplace. Students appreciate and confirm the greater ability to distinguish the essential elements and relations in real complex problems and therefore a better insight into requirements of their future work environment defined by AmI concept. Temporary results support the initial intention to form AmI landscape by the influence of early phases of its development.

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