# MOBILE COLLABORATIVE WORKPLACE SCENARIOS IN THE ICT INDUSTRY

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***Abstract:*** *Mobile collaborative workplaces offer flexibility, productivity and competitive advantages for the ICT industry. This paper examines future workplace scenarios and work behaviour against the background of the adoption of mobile technology and processes. Six futuristic, independently generated, generic scenarios were developed and analysed. The analysis identified research clusters and the critical dependent knowledge competencies. Concurrently, numbers of vision elements were evaluated through an innovative web based survey composed of several polls combined together. The paper concludes that the provision of cheap telecommunications bandwidth, ubiquitous mobile access, flexible business organisations, societal requirements and new technology will result in the network becoming the workplace for the knowledge worker.*

***Keywords:*** *Mobile workplace, Telecommunications, Security, Business organisation, e-professionals*

## 1. INTRODUCTION

Global corporate and SME industries need to improve their productivity and competitiveness in order to both survive and thrive in an increasingly competitive environment. To achieve higher productivity levels and flexible business practices, there is an increasing use of mobile related technology and organisational structures. The introduction of mobile technology in the Finnish forestry and paper industry saw a 40 % increase in the productivity levels between 1995-2002 [1]. The decreasing cost of high bandwidth fixed and wireless telecommunication links has stimulated the move towards decentralisation and networked organisation [2, 3].

In support of the need for future mobile workplaces, it is essential to understand the technological, organisational, societal and regulatory impact of mobile solutions. The EU Specific Support Action MOSAIC is to 'accelerate innovation in Mobile worker Support Environments by shaping future research and innovation activities in Europe' [4]. This in part achieved by examining existing case studies, vision scenarios and roadmaps development, and anticipating future needs and innovations.

This article specifically deals with the elicitation of future work practices in the short to medium term by developing innovative generic vision scenarios that anticipate various aspects such as organisational and technological work practices. Six generic vision scenarios have been developed, within the MOSAIC project, covering a variety of areas from large organisations to individual contractors. These six scenarios were analysed and an RTD matrix was derived highlighting core research topics and research issues. Concurrently, vision elements were evaluated by surveying the opinion of over a 100 industry and research stakeholders.

This article is organised as follows. Section 2 gives an overview of some of the main driving forces behind an increasingly mobile workplace. Section 3 gives a summary of the scenarios, with a more elaborate description of three. Section 4 shows the research clusters and competencies derived from the vision scenarios. Section 5 describes the results of a vision research survey of stakeholders. Section 6 analyses the i$^3$Workplace and section 7 summarises and concludes this work.

## 2. MOBILE WORK DRIVING FACTORS

The driving factors behind the introduction of greater mobility into the work flow, practices and organisation are both stimulated by competitive globalisation needs, technological availability and the need to generate new technological advances.

*Future Workplace*

The "Agile Workplace" study report by Gartner and MIT, published in Dec 2001, recommended moving beyond alignment and towards work-centric agile workplaces [5]. It concluded that agile workplaces were representing the next important step in workplace evolution and alignment of space and work was considered innovative, if not radical, only a decade ago but then became a mainstream practice. Though it was also recognised in this study report that workplace performance evaluation is a difficult proposition and cited a familiar quip saying about it: "Ask twelve experts how to evaluate the effectiveness of a workplace and you will get back thirteen answers".

Within the Agile Workplace study report, four distinct workplace styles have been identified:

- "Siloed" Work style: This is a classic industrial model where work is highly individualised, differentiated and prescriptive. The workplace strategy is built around the "Taylorist" theory of work efficiency.
- Nomadic work style: The enterprise or work unit places a high premium on employee mobility with minimum emphasis on collaboration.
- Huddled Work style: Work unit is highly collaborative and team-based, but it supports a minimum level of employee mobility.
- "Repertory" Work style: The repertory work style is characterised by a high degree of collaboration combined with a high degree of employee flexibility and mobility. A key element of the repertory work style is the importance of communities as a social analogy to the virtual team structure.

They came to the conclusion that different work styles require different workplace services. Each of the work styles formed by the workplace framework dictates the need for a different blend of workplace services. As enterprises shift more to higher degrees of mobility and collaborative work styles, demands on integrative workplace services become even more complex and demanding.

The four different work styles are presented in a figure having two axes, one is representing the degree of mobility and the other is representing the degree of collaborative culture and classified with focus on either people or place.

*Workplace Organisational Models:* The shifts in workplace style have resulted in different workplace organisational structures. Within their research, they have identified three new workplace models in addition to the traditional functional or departmental models.

- Integrated Model: The integrated model brings together the professional disciplines required to develop, acquire and service a highly distributed workplace including facilities, real estate, IT and employee services within a single workplace organisation.
- Governance Model: The governance workplace model achieves integration at two

levels in the organisation. At the strategic level, workplace plans, strategy and programs are developed within the context of a workplace board or steering committee that consists of management representatives from the key workplace functions: facilities, real estate, IT, human resources, procurement, legal and finance.

- Hybrid Model: The hybrid model combines the organisational features of the integrated model and governance model. Here, executives of the workplace functions report into an executive committee, where matters of policy and strategy are coordinated and integrated.

In the 2004 UK survey on flexible working, it is mentioned that "The Holy grail for any organisation is to assess employees' productivity and increase it" [6]. However, in this case productivity is subjective and depends on many factors such as motivation, well-being, morale, job satisfaction, and level of provided support as revealed in this survey. Other research studies are clearly showing that the pressure of business overload and bad management is strongly affecting physical, emotional, and behavioural health at work.

*Access technology*

Work has started on fourth generation mobile networks, through the World Wireless Research Forum (WWRF), which envisions a user centric design approach [7]. The technologies that a 4G system will incorporate include multi-modal user interfaces, mobility aware service and application execution platforms, network technology supporting pervasive connectivity with QoS on demand guarantees to more flexible and efficient use of radio spectrum. To finally serve these future requirements, new hardware and software technologies including man-machine interface (MMI), improved memory, processing and battery performance as well as new software and system design approaches are required and a new way of thinking in terms of regulation, rights and resource sharing needs to be implemented.
Development for new radio access technologies in 4G systems will provide a variety of secure systems with very short range, to global coverage, point to point, multicast/broadcast, and planned or ad-hoc networks. These systems will be based on adaptive, spectrally efficient technologies (adaptive and multiple-antenna techniques, multi user detection, and interference cancellation) and source driven transmission (increases the individual link capacity). To ensure always best connected multi –access vision, different radio interfaces must coexist and co-operate with existing radio systems by inter-working mechanisms and radio re-configurability (programmable hardware). The key components of access are transceivers & antennas, physical transmission schemes and medium access. The World Radio Congress (WRC) 2007 offers an important milestone for the access timeline as a wide variety of spectrum related topics such as spectrum sharing and co-farming will be decided upon in the licensed and unlicensed bands. [8].

Product solutions based on the Wimax standard will initially act as a backbone network connecting wi-fi hotspots to the fixed network, before expanding into providing mobile services. An increasing use of sensor networks, especially the use of Radio Frequency ID (RFID) technology will, in the short term, be used in large organisations to handle the flow of their products. [9]

*Work processes and procedures*

Enterprise Resource Planning (ERP) has focused on codifying processes such as sales, order processing and fulfilment, production and material resource planning, financial planning, logistics, management, finance, R&D and implementing them in ICT[10]. Future ERP applications will be capable of integrating value chain activities in the mobile workplace to deliver mission critical IT applications while maintaining quality management. Future changes will see the incorporation of workflow systems to automate the flow of documents and business transactions including EDI and Web Services.

Interconnected, the value chains of different companies comprise a value network. In the value network, ICT changes the work processes by increasing the level of standardization of interfaces and by codification of knowledge and information [11]. Resulting ICT components will become standardized and escape to a global scale resulting in the growth of Knowledge Intensive Services (KIBS) and offshore sourcing [12, 13].

For a global Service Provider there are two conflicting areas, whose *combination creates the competitive advantage*

- How to globalize the chosen Focus Applications and Services.
- How to localize the Applications and Services for Customer use.

The horizontal (globally generic) parts of the offering may become commodities (like All-IP networks, maintenance and operation) and the value may move to other parts of the value network (decommoditization) [14]. This leads to a global enterprise strategy where Global Focus is created by Choosing Customer Verticals, and *Developing* Decommoditized IPRs, Common Applications, Components, Process Models and Service Level Agreements used locally. Local Presence in turn is created by applying the above decommoditized offerings using local (franchised or subcontracted) workforce to provide the Commoditized Parts. (This is a major trend over the next 10 years).

Service/Product integration patterns have been moving to embed software/content in the product, have network services combined to the products and provide e-services and Product/service optimization w.r.t. Supply Chain Management (SCM). The business, production and service processes are being automated and integrated, as well as resource scheduling and optimization, customer/session management and support process's including mobile communication. The perceived customer value can be integrated in the product/service profiling using yield management, Customer Relationship Management (CRM) and pricing. This process integration inside firms will extend between firms and public players in the next 10 years so that finally, necessary elements of the value network will have mobile support. [9]

## 3. MOBILE COLLABORATIVE WORKPLACES

The research activity in MOSAIC, in terms of visioning, is showing a new emerging mobile workplace approach characterised as the "*People and Network-centric Workplace*" approach. This approach is intended to bridge the gap between performance, purpose, balance and networking within an inclusive, innovative and interconnected workplace. This approach is named in short the *i³Workplace*. It means that you don't need to go to your office to be at your workplace but rather the workplace is following you wherever you are. In fact, the network becomes the 'global' workplace and provides the ability to interact with communities' peers wherever they are and whenever there is a need. The i³Workplace approach is based on three main capabilities for the mobile workplace:

- Inclusive: Communities flat and open structure allows including new comers at any time when needed.
- Innovative: Multiple interactions among multidisciplinary competencies at the crossroads of experiences are dramatically increasing the creativity potential.
- Inter-connected: Permanent wireless connection established anywhere at anytime provide much more flexibility and adaptability to any situation.

The i³Workplace serves the Purpose of mobile collaborative working, enables Networking among multidisciplinary individuals' competencies, and supports the overall Performance of the knowledge workers while preserving work-life Balance.

For this purpose, the i³Workplace effectiveness map has been drafted (Figure 1). It is constituted of two complementary levels looking both outwards at organisational behaviour and inwards at individual support needs. This map is intended to both measures the whole work community and prescribes ways to improve the workplace.

Effectiveness Map builds on four complementary domains of working environments:

- Purpose
- Performance
- Balance
- Networking

Each domain is constituted of four ability elements aligned with four organisational elements. The i³Workplace effectiveness Map is constituted of sixteen ability elements corresponding to sixteen organisational elements used throughout the transition from traditional workplaces towards "On Demand" i³Workplaces.

The *performance* domain represents how much individuals gain and sustain healthy levels of

high performance. The result of healthy high performance, either as single or group, is that all actions and outcomes provide personal and professional efficiency, growth, achievement and effectiveness both for individuals, and for the organisation.

The *purpose* domain represents a true alignment of each individual with their role and their group, with the mission, vision as well as values of the organisation. Purpose is how much individuals and teams act in ways that produce the highest possible commitment and pride in what they do and achieve at work. It generates a mutual understanding, confidence and inclusion.

The *balance* domain represents a fundamental equilibrium between each individual and its parent organisation(s), which provides the individual wellness forming the source of organisation appropriateness. Balance preserves appreciation and solidarity among individuals and enables an organisation to meet its targets through a maximum individual engagement while keeping a proper level of resilience and evolution.

The *networking* domain represents how much everyone is able to relate to one another with ease and understanding, and to value relationships at all levels. Networking ensures that relationships are not only healthy within the organisation but also with all stakeholders. It creates the layers of communication, ensures the continuity across heterogeneous platforms, wires the communities that enable an efficient and effective collaboration level.

*Vision Scenario Development*

The use of vision scenarios is a common technique to anticipate future work situations and technological requirements [15]. Scenarios fulfil several functions during the design process by providing a simple description of a problem, provide a common language for participants, provide a concrete description of a design solution, and assist in creativity and realisation. Six generic scenarios were developed as part of the MOSAIC project [16]. A concise summary of all six scenarios is shown in table 1. Short summaries of three of the scenarios are provided here.

*Scenario 1: E-professionals in self-organising communities*

This scenario describes how a bank implements a software audit by using e-professionals in self-organising teams The project actors consist of a project manager, a software development team and a field team. The software development and field teams are arranged as self-organising teams acting under the control of a project manager.

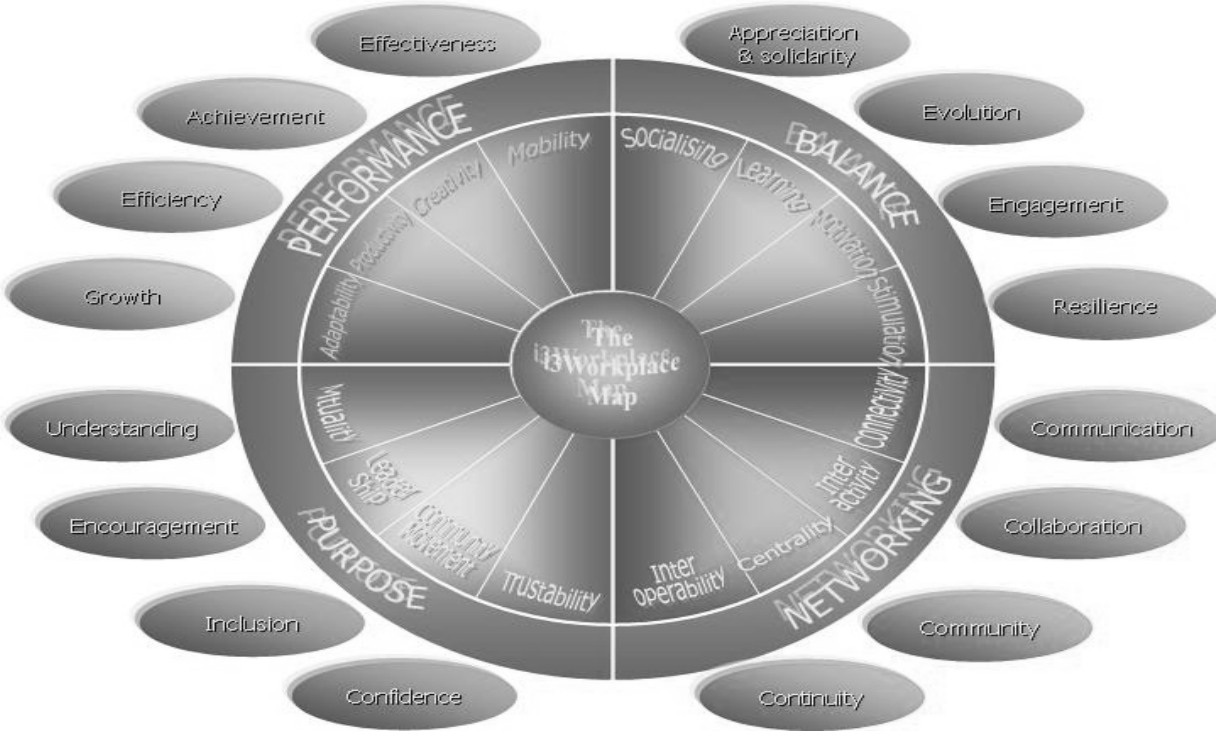


**Fig. 1.** The i[3]Workplace effectiveness map

**Table 1:** Short summary of the six generic MOSAIC Scenarios found in deliverable D1.1 [16]

| **Scenario Name** | **Scenario description** | **Main Highlights** | **Main technologies/solutions** |
|---|---|---|---|
| Global Product Creation in a networked company | Describes a global product creation cycle | Access a global talent pool. Develop complex value chain networks | Hot-desking<br>Context sensitive- locations<br>Privacy/security<br>Interoperability<br>Multi-access wireless technology |
| E-professionals in self-organising communities | Carrying out a software licensing audit of a bank | Bank hires individual contractors.<br>Contractors develop scanner software<br>Audit team travel to branch locations to conduct audit | Community workplaces<br>Location based services<br>Context awareness<br>Security<br>Mixed Reality/wearable computing.<br>ad-hoc networking |
| Coordinating distributed work | Aerospace maintenance activities | Engine problem noted in aircraft<br>maintenance team prepared.<br>Maintenance team repair aircraft | 'hands free'/Wearable computing<br>GRID<br>VR training/rehearsal<br>Security<br>Global Wireless access |
| Mobile workplaces in an SME | SME's collaborating in a self-coordinated network. | A group of SME's collaborate to share resources and expenses.<br>Can add new SME<br>Adapt SME network to demands of clients | Personal network presence telepresence remote meetings ad-hoc contextualised collaborations<br>Community workspaces.<br>context – awareness<br>interoperability |
| Community based collaboration workplace | Consultant working for a furniture company | An expert, who is a member of a community of professionals, is hired by a furniture company.<br>Expert facilitates collaboration with other companies to increase value.<br>Expert highly mobile | Community workspaces<br>IP access everywhere/anytime.<br>wearable computing/foldable screens<br>Flexible & Mobile work arrangements |
| Mobile Competence workers in global supply chains | Purchasing manager in a global supply chain | Manager is responsible for purchasing between global companies, Travels a lot<br>Needs constant access to information/context | Security<br>Location based services<br>Shared workspaces<br>Multi-lingual support<br>Ad-hoc collaboration |

The development team is created by hiring individual e-professionals who are responsible for establishing their own support structure (communication ,overheads, office space, design tools, work practices).

The field teams are visit different sites and are highly mobile. Their workplace is wherever they are scheduled to be. For these teams, support is needed to allow communication and coordination between the team members and the software development teams. They also require location-based services to find the sites and context aware services to manage their travel and expense accounts.

The scenario looks at creating a centralised workspace/per team that meet the requirements of each team and providing this to each team member anytime/anywhere. As well as acting as a storage point for information, it also acts as a communication tool, giving quick access to each team member.

Problems that occur for teams in this scenario include security policies, contract negotiations, IPR agreements, inter-cultural and time zone differences. Additionally, technical e-professionals will be required to deal with legal issues, placing heavy burdens on their support and maintenance costs. The temporary nature of the self-organising teams has pitfalls in that it can increase job insecurity. For the employer, the difficulty may come when all of the most qualified workers are already busy and unavailable.

Co-located team members will operate short-range ad-hoc networks while remotely located teams will rely on wide area networks for communication. The scenario identified a number of other technologies such as e-payment systems and context aware services to update travel expenses. The scenario also identifies the use of biometric data for security.

*Scenario 2: Community-based collaborative workplace*

Mobile work is enabled through community based collaborative mobile workplaces available anywhere at anytime, following the workers wherever they are. There is no more need to carry documents, or heavy equipment, and find power and network sockets. This scenario is based on the use of small wireless computing device fitting in the pocket of a jacket or on the wrist, enabling instant connection to other devices (i.e. flat screen in the train or plane) and to the Internet, independent from place and time. The network becomes the workplace! Meaning you can be virtually and instantaneously co-located with your communities' peers and having access to whatever knowledge or expert you need.

The main actor in this story scenario is an independent expert member of a community of professionals and practices, operating through the Internet, specialised in the domain of collaboration engineering whose role is to facilitate the innovation collaborative process of a traditional furniture company with other complementary companies that could bring more value to their products. The developed scenario describes the expert's journey to identify opportunities for collaboration, travelling patterns and the way he is communicating, working and living, as well as the role of technologies in his working and living environment.

Business drivers in this vision scenario are clearly flexible and mobile working arrangements, giving improvements that lead to higher productivity and creativity potential and innovation opportunities.

There are many social and organisational challenges and requirements, such as turning inside-out competencies, the evolution of work regulation and contractual employment, the move towards a collaborative attitude, catalysing the social role of flexible mobile workers through the involvement within communities of knowledge, communities of professionals, level of motivation and stimulation as well as engagement, virtual collocation of multidisciplinary experts, improve the level of trust and trustable knowledge.

A number of technological challenges and requirements appear in this vision scenario, mainly in terms of miniaturised wearable computing devices including wireless connection to IP access anywhere at anytime as well as miniaturised tracking device, a ring replaces the traditional mouse, projected or fold-out plastic keyboard and screen, large flat screens availability almost everywhere people are staying and travelling.

Communities of either professionals or practices, operating through the Internet, play an important role as knowledge and social catalyser through a quasi- permanent connection with members which largely facilitate access to existing knowledge and appropriate competencies. Communities are also seen as a new form of organisation pushing a transition from management by control towards self-organised, self-managed by stimulation and motivation ensuring a much higher level of workers engagement in their activities and giving them more flexibility to balance work and life. A Number of community services will have to be developed in the near future. One of the social activities presented in this vision

scenario is the "conviviality space" providing a lot of opportunities to socialise with other members, based for example on common interests, in open discussion about various subjects that one can decide to join for few minutes in order to relax and build trust and confidence among people and stimulate creativity thinking as well.
Another important aspect of the Community based Collaborative Mobile Workplaces vision scenario is its good potential coverage of the four domains (Purpose, Networking, Balance and Performance) of the $I^3$Workplace Effectiveness Map

*Scenario 3 Mobile Competence Workers in global supply chains*

The scenario shows how mobile technology can improve work and make life easier for competence workers in a globally operating supply chain. This scenario describes the work of a lead buyer of a globally operated and distributed trading company. The company is hierarchically structured with (almost) autonomous subsidiary companies in many countries and time zones. Purchasing is handled by decentralized purchase companies, one for each country, sometimes even for regions. The lead buyer works in a central purchasing unit and is responsible for strategic purchasing between the regional purchasing companies. She frequently has to travel worldwide to coordinate purchasing with regional purchase managers and negotiate with suppliers. Her work is characterized by a dependency on inhouse databases and information systems as well as a high degree of informal communication and document exchange with internal staff and external suppliers. The lead buyer frequently works at home or at other premises.

ICT in the company consists of standard inhouse applications which are networked (database systems, document management system, etc.). Security is an important issue, considering the amount of industrial espionage world-wide. The ICT system is quite regulated with a high degree of networking, but between subsidiaries, there is mainly informal communication and unstructured exchange of documents.

The scenario reflects a trend to more dynamic and flexible workplace organizational structures. Other trends focus on mixed forms of teleworking (as opposed to sedentary telework at home), more autonomy for the individual in the work organisation, excellent security for ubiquitous access to data and the blending of professional and private spheres. The scenario also identifies globally networked companies consisting of decentralized subsidiaries and support for an international multi-cultural workforce.

Challenges identified in this scenario are: ubiquitous and secure access to the Internet and to a wide range of devices, in addition to mobile devices being carried around; very small mobile devices with standardized interfaces to communication protocols and peripheral devices and with fold-out screens for PDAs; location-based services; multi-linguality; ad-hoc contextualized collaboration; flexible access to shared workspaces. Communication between mobile devices must be capable of supporting interoperability, scalability and adaptiveness of the data.

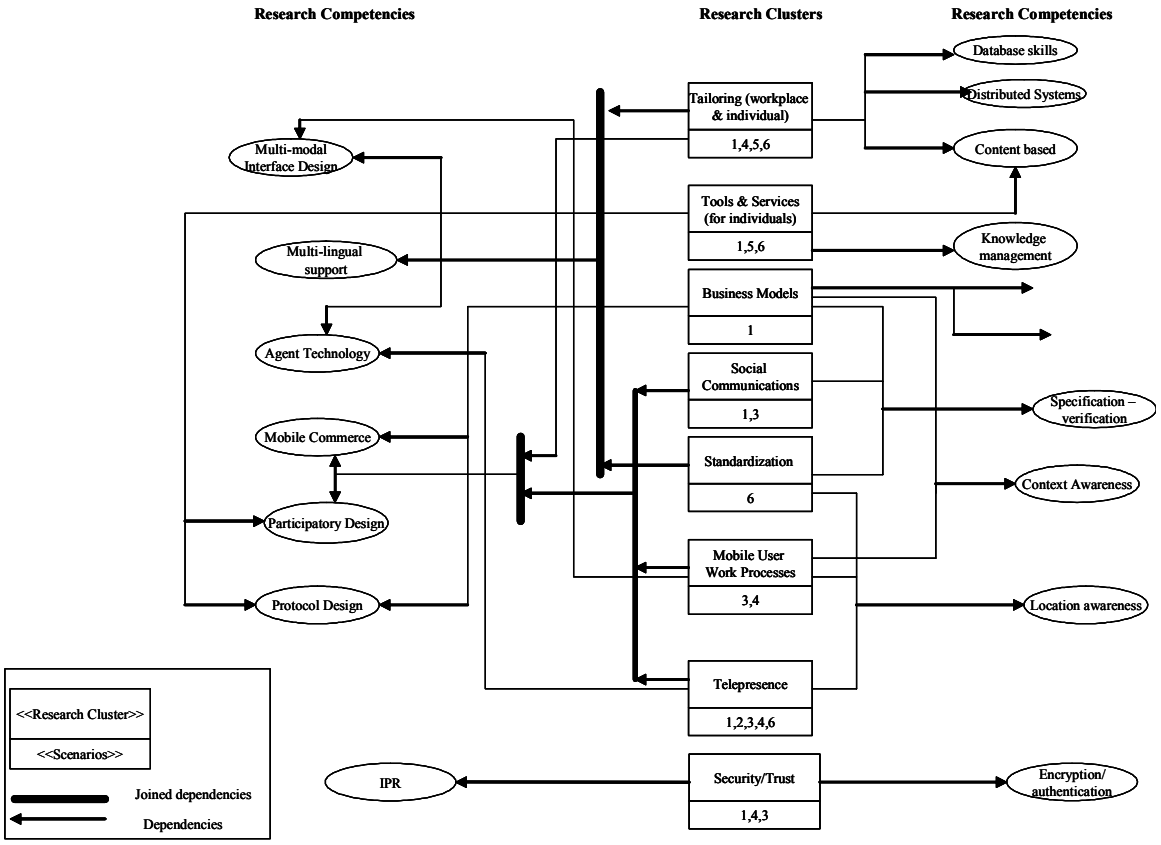


**Fig. 2.** Research cluster –competency relationship chart. Each research cluster has a list of the generic scenarios in which they are found. Security/trust construct is pervasive to all clusters and competencies.

## 4. SCENARIO ANALYSIS

The six generic scenarios were individually analyzed. The dominant research issues necessary for the execution of each scenario was identified and classified. In total 36 general research issues were identified covering technological, usability, organizational, economic and regulatory issues. These research issues were analyzed and grouped into 11 research clusters. [17]

A second round of analysis from the viewpoint of the research community narrowed this to eight basic research clusters. Each research cluster requires a set of competencies, and the relationship between the research clusters and the competencies is shown in figure 2. The main research clusters are

- *Tailoring- (Workplace & individual)* – customization & personalization of collaborative mobile work workplaces and individual spaces
- *Tools & Services* – Tools and services will empower the individuals working e-professionals within the mobile workplace.
- *Business models* – mobile work requires the development of new business models that focus on collaborative service driven solutions instead of working through an application. Specialized service providers are expected to operate play a part in global supply and in complex value chains value
- *Social Communications* – Modeling social behavior models to support cross –cultural and distant communication.
  *Standardization* – Develop global and ad-hoc standards, reference models for ambient environments, telecommunications and mobile workplace to facilitate interoperability and market penetration.
- *Mobile User Work process's*- Coordination of business process's at different levels (global data).
- *Telepresence* – Greater information flows and collaborative work activities across large and short distances will need greater mutual

awareness and presence to support task completion.
- *Security/Trust* – Security and trust are key in supporting more ad-hoc cooperation spaces between arbitrary partners.

Figure 2 also shows under the title of each research cluster, the generic scenarios in which that cluster is relevant. Of these clusters, it should be pointed out that the Security and Telepresence are the only research clusters that can be found in all six scenarios. The importance of telepresence is that it aims to improve worker performance and productivity between remote sites by providing a richer sense of presence [18]. Higher and cheaper bandwidth, improved codec's, sensory networks and distributed computing are making it possible to explore new implementations of telepresence. The Security research cluster is important in that it is pervasive in all aspects of the mobile workplace, as without some degree of security and trust, it would be very difficult to function commercially.

Competencies describe general areas of research knowledge. It does not explicitly specify what is needed within these fields for the mobile workplace, but rather what collection of competencies is needed for each research cluster. It also shows the multidisciplinary approach needed for future RTD projects. Seventeen critical competencies were identified. The title for some is very inclusive, hence the competency 'protocol design' covers a variety of wireless standards, bearer services, middleware, and internet protocols. The competency 'multi-modal Interface design' can cover the design of interfaces to airplanes, cars, computer tools, web pages, wearable computing to mobile phones as examples.

The most important competencies are probably those which are related to the most research clusters. These are participatory design (5), protocol design (5), and Tailoring (5). The next most common competencies are agent technology (3), Multi-modal interface design (3), location awareness (3), Context Awareness (3) and Specification-Verification (3).

## 5. A VISION OF FUTURE MOBILE WORKPLACES: SURVEY RESULTS

Concurrently to the drafting of this map, a survey dedicated to "Future Mobile Workplaces" has been conducted within an innovative way of consulting the MOSAIC project Network and AMI@Work research communities through the combination of complementary polls posted on the MOSAIC website. This survey is organised through polls.
The assertions presented in the following polls are contributing to the shaping of the vision scenarios and roadmap for the Mobile Workplace. They are permanently monitored to watch their evolution and to compare their values with the predicted ones. Each assertion implies a certain impact from the point of view of Mobile Workplace. The question that respondents are requested to answer is: "Do you believe that the assertion will effectively come true (by 2010) to the extent to actually cause a significant impact on the Mobile Workplace implementation scenario?"
When expressing opinions, it is requested to tick only one of the 3 following answers:

**Probably**: It is mostly going to happen. The dimension of the phenomenon by 2010 will be such to require significant adaptation/evolution of Mobile Workplace.
**Uncertain**: It remains very difficult to anticipate. There is no evidence that the phenomenon is occurring to the extent to significantly impact the Mobile Workplace by 2010.
**Unlikely**: It seems mostly not realistic. There is no evidence that the phenomenon will occur, or it will take much longer than a decade to be realised to a significant extent.

List of the polls constituting the survey on Future Mobile Workplaces:
- Human aspects in mobility
- Mobility and work settings
- Mobile applications & services
- Mobile services platform & awareness
- Mobile access technology
- Mobility policy & regulations.

Related polls are translated into questions to which community researchers are requested to respond whether they think it will happen before 2010 or it still remain uncertain or even it will not happen at all. For sure, there may be elements that respondents would like to have but

will not happen because the actual research effort deployed on this element in not sufficient to get it before 2010.

Another interesting possibility is to ask respondents to rate the importance or priority they foresee for each element of the complementary perspectives which means, more or less, what element they would like to have in priority. Then it could also be good to compare the rated importance for each element with the fact it is believed or predicted as something that will happen or not.

The website approach of using complementary polls provides a lot of flexibility to respondents as they can start with voting for one poll and stop. Then they can come back and continue with another poll or vote for several polls during the same visit to the website. Furthermore, there is the possibility to look at the actual resulting figures which constitutes another motivation to vote and therefore contribute to the shaping of the vision in contributing to the emergence of the overall community opinion.

Last but not least, each polls group could be associated with another one like the rating of importance for each element that would provide much more valuable indications in combining also the resulting figures of the assertion polls with the rated importance ones.

Results of poll for human aspects in mobility is shown in the figure 3. Actual resulting polls' figures are showing that only very few elements did not get a majority of the vote saying it will probably happen. Only 5 of the overall 31 elements did not get the majority of votes on "Probably". No element gets the majority of votes on "Unlikely". Two elements, in the legal perspective, got the majority on "Uncertain" which means that only 3 elements were well balanced between "Probably" and "Uncertain".
This polling approach could also be used to assess barriers to mobile workplaces as well as enablers and drivers. However, it should be noticed that the most interesting added-value of conducting on-line survey through community website polls are the immediate resulting figures to oversee what the community overall opinion is regarding a dedicated aspect. In this case, 'immediate' means days or weeks to get resulting figures instead of months or often years for lengthy traditional surveys. This is really something fully appreciated especially when researchers conducting a survey are trying to figure out eventual impacts on future research challenges.


**Fig. 3.** Poll T1 Human Aspect in mobility

This type of 'instantaneous' on-line survey through the combination of different complementary polls where community members do not need to spend a lot of time to respond could also be used in other businesses to assess for example customer satisfaction. It would contribute to provide more confidence to website visitors when seeing for example that more than 90% of customers are globally satisfied by the offered services.

*Human aspects in Mobility*

It appears very clearly that most of the respondents, about 85%, are already convinced about the implementation of flexible work arrangements before 2010 (figure 3). In fact, it has already started based often on the motivation of costs cutting and increases of productivity (less wasted time) as a benefit for the organisation and on gaining more freedom for employees in becoming self-organised. Surprisingly, a majority, about 66%, do believe that future mobile workspaces will better integrate social, learning and work activities. Even more surprisingly, remote socialising is seen, by 50% of the voters, as something that could happen before 2010. It seems there is

strong wish to get some kind of conviviality space, like the coffee machine area, where employees could have unplanned public or private discussions.

Collaboration among distributed competencies is also predicted by 72% of respondents as something that will happen while it is already becoming a reality. Recruit 'on demand' independent experts is gaining 60% of the votes, as part of the heavily required flexibility by organisations. This is something that could considerably reduce recruitment hardhack as the contracted worker is not really recruited as an employee but rather for a short period of time.
Develop career within professional communities did reach 47% while 46% of voters are thinking it remains still uncertain to anticipate whether it will happen before 2010. It is interesting to notice that only 6% do believe it will not happen at all. It means certainly that people are seeing communities are a new motivating and stimulating form of organisation that is going to replace the traditional hierarchical management by control inherited from the army organisation.

*Mobility and work settings*

A large majority of the voters predicted that 'on demand' co-operative workspaces, community driven workspaces, workspaces plug and play capabilities, and workspace access anywhere at anytime, as well as collaboration in shared workspaces will happen before 2010 (figure 4). It may be regarded as very optimistic position whether information and communication technologies are included in this prediction but considering only remote organisational aspects of workspaces may appear more realistic but still subject to discussion.

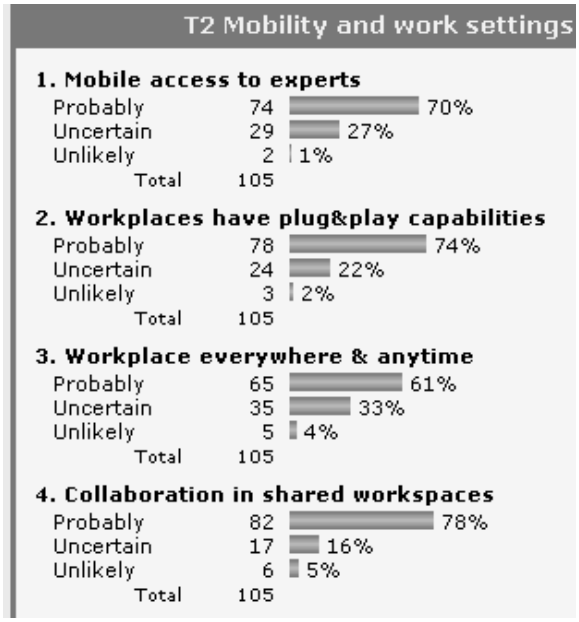


**Fig. 4.** Poll T2 Mobility and work settings

Workspace access wherever you are and whenever you need it, looks like a dream that almost everyone is expecting to come a reality. It will become a real business driver very soon when people will be used enough to stay permanently connected within city areas as being missing electricity and gas.

*Mobile applications & services*

As for the previous perspective a large majority of the voters predicted that emergence of semantic- based applications, powerful and less expensive delivery of content, mobile access to experts and mobile workers to share and modify designs, as well as the integration of multimedia, telephony and computing in consumers' applications will become a reality in 2010 (figure 5). Again, it may look very optimistic but highly rely on whether semantic knowledge technologies and wearable computing and connection will reach a certain degree of maturity to enable all these service elements. It should be noticed that delivering content has reached the incredible level of 81% which really means it is a hot topic and best wish of most of us.

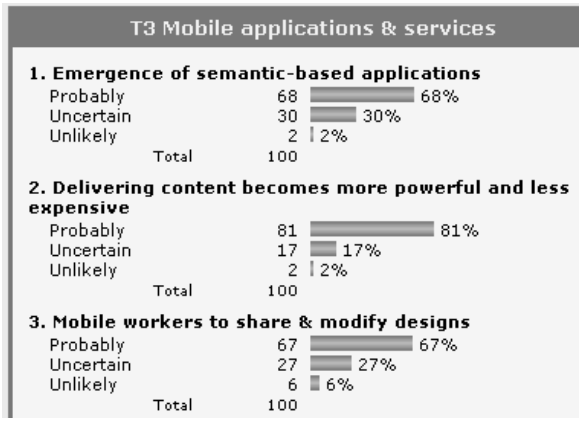


**Fig. 5.** Poll T3 Mobile applications and Services

*Mobile services platform & awareness*

Most of these vision elements have got a majority of votes, except the vision element dedicated to the standardised interaction between mobile devices and their environment where only 46% of voters are considering it may happen before 2010 (figure 6).


**Fig. 6.** Poll T4 Mobile Services and awareness

Collaboration middleware, context-awareness and "on demand" collaborative workspaces got respectively 73%, 72% and 71%. They could emerge rapidly depending on how much effort is invested in this research area. It should be noticed that there is a strategic objective in the IST work programme dedicated to collaborative working environments within the 5th call-for-proposals. A majority of respondents (58%) do also believe that community based workspaces is something that will happen before 2010. In fact, actual growth on the Internet of on-line communities and social networks having actually millions of users confirms this people interest about networking together.

*Mobile access technology*

One of the vision elements in this perspective was wrongly expressed into a single element while it should have been broken into 2 separate elements, one about head mounted display and another one on light & durable power supply. So, actually, the percentage of votes could be attributed to one or the other. Another vision element, "wearable wireless computing reaches maturity", has received the lowest majority score at 50% of votes. All the other elements have got more than 60% of votes; even the emergence of smart objects (miniaturisation of computing & connectivity) has reach 65%. IP connectivity wherever you are and whenever you need it got 73% and could become soon a reality but again depends on how much consumers will be willing to pay for it. Integrating multimedia, telephony and computing in consumer's applications did reach an incredible 90% meaning it is highly desirable (figure 7).

*Mobile policy & regulation*

This is the only vision perspective receiving majority for only one of its vision elements. for sure, this one dedicated to the employment regulation changing towards more flexible work may appear much more as an adaptation than a real dramatic change (figure 8). It may explain why 56% of respondents do believe it will happen before 2010. Unification of work regulation received a 21% unlikely greater than the 29% saying "probably" wile 48% votes saying it will remain "uncertain". It should be recognised that respondents were not legalist people but there is a sign showing that unification of work regulation, even for flexible work, is a very sensitive aspect of the European Union. The most interesting idea in term of vision element is the "multi-employment contracts backed-up by communities of professionals that reached a well balance score of 39% "probably" and 39% "uncertain" while "unlikely" got only 20%. One may conclude that communities of professionals are going to play an important role in the near future.

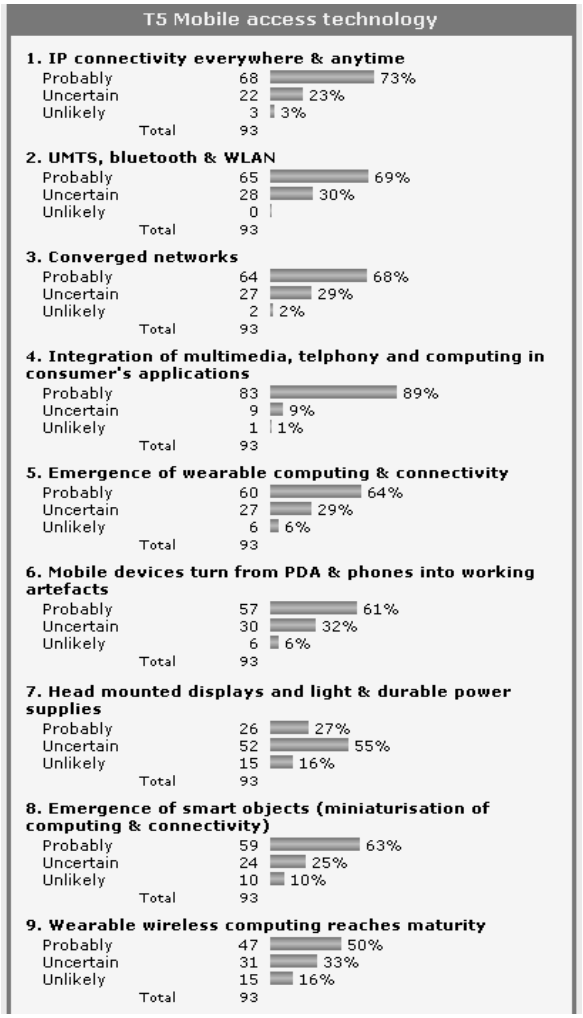


**Fig. 7.** Poll T5 Mobile Access Technology

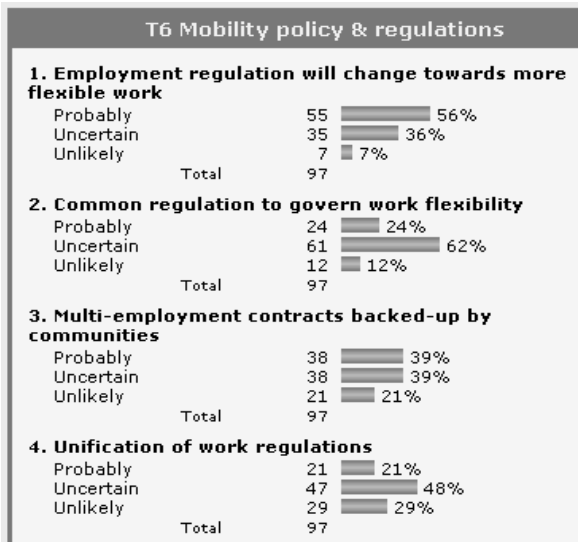


**Fig. 8**. Mobile Policy and regulation poll

## 6. EVALUATION OF THE VISION ELEMENTS WITHIN i³WORKPLACE EFFECTIVENESS MAP

As presented in the figure 9, the largest groups of vision elements, respectively 6 vision elements are coincident with the Mobility area of the Performance domain and 5 vision elements in the Connectivity area of the Networking domain.

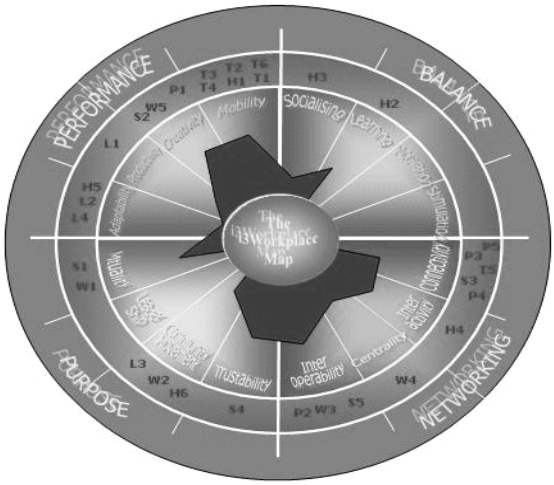


**Fig. 9.** Evaluation of the various vision elements scores within the i³Workplace Effectiveness Map

This is not really a big surprise to find Mobility and Connectivity areas grouping 1/3 of the total vision elements included in the survey as the main theme of the survey is "Future Mobile Workplaces". Other leading map areas are Creativity, Adaptability, Community Movement and Interoperability with 3 vision elements for each. Again, this is not very surprising as the Mobile Workplace should bring creativity, adaptability and interoperability capacities as well as being connected to communities for knowledge sharing and to provide openness and opportunities of socialising on the network.

There are several untouched areas such as Motivation and Stimulation areas of the Balance domain and the Leadership area of the Purpose domain where there isn't any corresponding vision element. The red surface in the figure 6 represents the average vote obtained for each area. On the 16 areas, there are only 3 of them that do not have any corresponding vision element and are not covered by the red surface.

## 7. CONCLUSIONS

Nowadays, the previous work-centric approach of workplace organisational models corresponding to different work styles is still appropriate. Nevertheless, there are new emerging practices, a "Networked" work style, where knowledge workers are practically permanently connected wirelessly with their peers and belongs to several communities of practice, knowledge communities or communities of professionals, to serve either business or social purposes. They could be working from their home, from a customer or supplier's site, or on the move in a plane or train.

Their main problem, beside organisational and social aspects, is to carry various heavy equipments while they can loose suddenly connection. The Future Mobile Workplace survey did reflect perfectly these different points. About 90% of respondents are willing to get a new wearable computing device that integrate multimedia, telephony and computing in consumer's applications. More than 70% predict convergence of networks and IP connectivity anywhere at anytime as well as collaborative and context-aware applications, and "on-demand" collaborative workspaces. A large majority requires more interactions among multidisciplinary competencies and plug&play capabilities as well as mobile access to experts. More than 80% of respondents predict the implementation of flexible working and the integration of social, learning and work activities.

In term of workplace organisational model, the emerging signal is on "External Global Model" which means that knowledge workers workplace is hosted by a service provider ensuring and guarantying permanent wireless connection to the network and shared applications anywhere at anytime. Knowledge workers can be mobile without having to worry that much about their workplace and working environment as their workspace will follow them wherever they have to go and whenever they need it.

A final remark is that there isn't any "universal" mobile workplace organisational model so far, due to the diversity of various legacy situations. Prediction is always a very difficult task because one needs to foresee the "small" signals. But we can predict for sure, due to cost-to-use and time-to-market pressure, that soon or later "The Network will become the Workplace" for every knowledge-worker.

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