THE INTERNATIONAL OFFICE OF THE FUTURE: A PROBLEM ANALYSIS
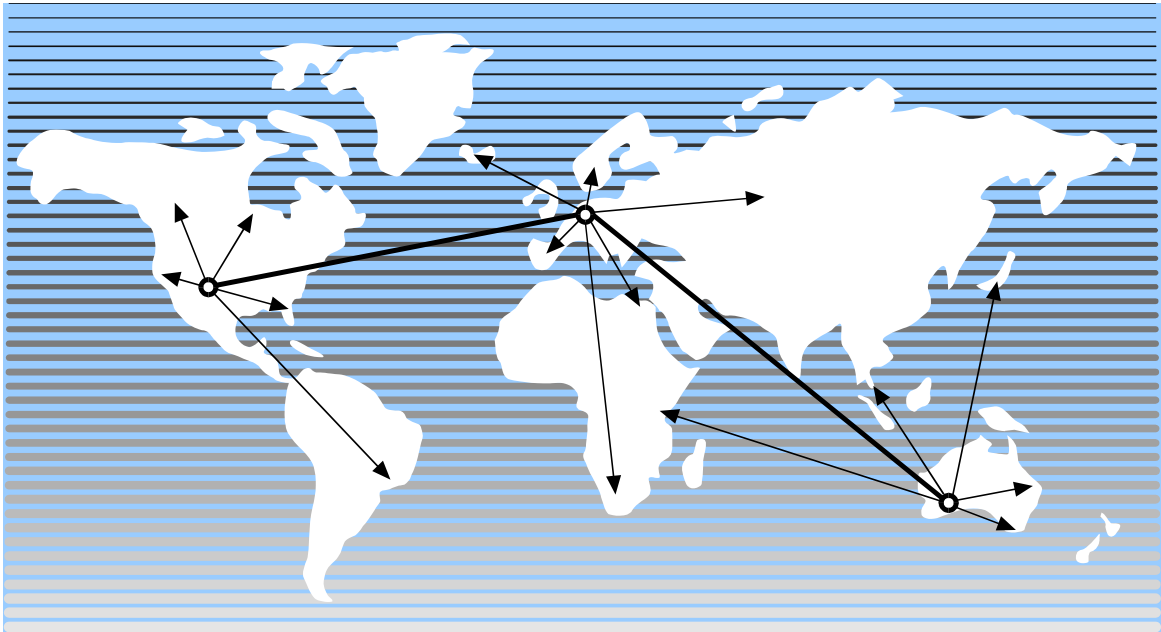
Edited by

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Preface

Globalization of business, internationalization of trade and the increasing prevalence of multi-cultural interdisciplinary teams are beginning to redefine the nature of office work. Different-time / different-place / different-culture workgroups will become the norm. Same-time/same-place/same-culture workgroups will become the exception. The international office of the future (IOF) will be a dramatically different environment than that which exists in the majority of today's organizations.

This emerging paradigm of office work gives rise to numerous questions. What are these issues? What design options or solution strategies exist to address these issues? How might these design options be best implemented? What are their implications? This monograph is the output of a first series of activities aimed at exploring the IOF concept. It contains the four position papers that were presented at the IFIP WG8.4 workshop *The International Office of the Future: A problem analysis*, held in association with the World Computer Congress in Hamburg (Germany), September 1994 and a report of two brainstorming sessions on the IOF, one in Hamburg and one shortly thereafter in San Sebastian (Spain).

The purpose of this monograph is to provide a stimulating input to those who wish to contribute to future IFIP activities on the IOF. The next activity will be the WG8.4 working conference, *The International Office of the Future: Design options and solution strategies*, which is to take place at the University of Arizona in Tucson, Arizona in April 1996. The purpose of this conference is to provide a forum and prototype environment in which researchers and practitioners can interact. Electronic meeting technologies and facilities will be available for participant use and evaluation.

The third part in the IOF trilogy will be a global multi-site working conference, *The International Office of the Future: Studies in practice*, to be held in September 1997 using the universities of Delft in the Netherlands, Curtin, in Western Austra-

lia, and Arizona in the USA as major hubs with telecommunications links to enable conference participants to experience the nature of a global organizational environment.

Thus strung together, we expect these three activities to surface the basic issues, generate ideas both conceptual and practical to address these issues, and report on and demonstrate how these ideas have been implemented and worked in practice. The insights gained in the process should enable us to bring effective international offices into being.

Delft
Curtin }, February 1995
Tucson

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Contents

The International Office of the Future: A search for issues and challenges

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This position paper investigates the concept of the "International Office of the Future" (IOF) from several angles in order to reconnoiter the grounds of research and development that lie between this yet unknown environment at the horizon and the offices and systems that presently surround us. This reconnaissance covers three dimensions: the technical, the organizational, and the international. The fundamental problems encountered on the way add up to a challenging, if not daunting agenda for research.

1. The International Office of the Future: What is it?

How to define an office? The notion is so ingrained in our society (Delgado, 1979) that we simply recognize one when we see one. But do we understand what we see? From comparison of a variety of studies of offices and office work, Hirschheim (1986) concludes that two different theoretical perspectives of the office dominate our thinking about offices: an analytical perspective and an interpretivist one. The former sees the office as an environment in which people perform a variety of functions in a rational and purposeful way to support the successful running of the organization. The latter sees the office in terms of mostly unstructured and informal human action that takes

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place in a social "arena" where power, ritual and myth dominate. As we pursue our search for IOF issues and challenges, we shall alternate between these two fundamentally different perspectives to obtain a richer picture.

Before we proceed, however, there is an issue to be resolved: Should we distinguish between the "office" and the organization it is part of? Verrijn-Stuart (1988) seems to support this view when he states that "an office is the organizational aspect embodying the activity of individuals or groups of individuals within the organization where one deals with the organization's information streams, which are often multi-media based." (p. 10) By this definition, information intensive organizations such as banks, insurance companies, and most government agencies *are* offices. For organizations with a "physical" primary process, such as manufacturing or transport, the distinction may still seem appropriate – a substantial part of the organization's activities (when measured in employee time) can be characterized as "non-office work" – but as these organizations adapt to the demands of today's complex, hostile and turbulent environment (Huber 1984), it is fading. Modern manufacturing organizations are "workerless factories", run by highly trained information workers. As (trans)shipment is further mechanized and information technology moves into the cabins of trucks and straddle carriers, the teamster's workplace becomes a "desk on wheels". Eventually, the blue collar worker will join the blue whale on the list of endangered species.

It seems justified, therefore, to dismiss the issue of how to define the notion of "office" vis à vis "organization" as being irrelevant. If one prefers to read "IOF" as the "International *Organization* of the Future", it would make little difference.

"International" *does* make a difference. There is no doubt that future organizations will be international in the sense that their activities will affect and be affected by the activities of many other organizations situated in other countries. The jet airplane and the communication satellite have played the key role in transforming the planet into a global economic village (Naisbitt

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& Aburdene 1990). Not only has modern communication technology removed the information "float", thereby increasing complexity and turbulence, it also removed distance as a damping factor in international business. Since all business runs through the office, the "I" in IOF is there to stay. Globalization is a major trend, enabled and sustained by further developments in the areas of transportation, information and communication technology.

With "international" and "office" sufficiently introduced, we must go back to the "future" aspect of the IOF. If "pure offices" are to be the shape future of organizations, what will these look like? The future cannot be known, but it can be guessed at. With respect to future office environments, gues-ses may be educated and predictions may even come true, eventually. As a first step it suffices to formulate questions that will lead to issues that are both relevant and researchable.

To arrive at such questions, we shall explore the IOF along three dimensions: the *technological*, the *organizational* and the *international*. By extrapolating trends in the development of information and communication technologies, the nature, scope, power and limitations of these technologies can be estimated. Less certain, but no less crucial will be our estimate of the impact these technologies will have on the way man will organize his purposeful activities. Both empirical findings and conceptual work in the area of new organizational forms provide fertile ground for raising questions.

2. Technologies and systems: Everything works, but does it help?

While the basic characteristics of the office environment may have remained relatively unchanged over many years, there have been very significant changes in the technology available to support the office worker. Hollingsworth (1993) distinguishes three generations of office systems to date and outlines a fourth generation that is to come. The first generation (1970's) was characterized by stand-alone, dedicated systems

for text manipulation with little or no facilities for document exchange. The second generation (1980's) emerged as the PC became the strategic office desktop device. The sheer size of the PC market, the improved ease-of-use thanks to windows, icons, mouse and pointer ("WIMP") technology, and the introduction of local area networks overcame the limitations that would have made PC technology unsuited for supporting office work. PC networked operating systems provided facilities for administering a local work group, sharing files and printers, and transferring electronic messages between users. Further developments of both PC-based office products and (mainframe) server based products paved the way for the client-server concept that characterizes the third generation office systems (1990's). On top of the platform and network infrastructure, global groupware infrastructure such as *advanced e-mail* (supporting interchange of a variety of information types), *distributed object stores* (to reduce redundancy) and *directory services* (e.g. the X.500 standard) is available today. On top of this, groupware applications are implemented, ranging from form-based applications that replace structured, paper-based processes to conferencing applications that support unstructured tasks such as brainstorming and idea generation. Some of these applications – though groupware-enabled – will be personal, supporting word processing and individual decision making tasks. For lack of "true" standards, gateways, filters and conversion applications provide the link with external systems. Emerging technology trends, such as increasing mobility, integration of telephony, multi-media and video-conferencing, distributed object management, information filtering and intelligent searching can be accommodated within the client-server framework. Therefore, Hollings-worth predicts that the most likely characteristics of the fourth generation office will be an increasing adoption of object-oriented technology and a closer link between office applications and business processes.

Hollingsworth's account of four generations provides a good overview of subsequent technologies and how they found their way into the office, but it does not address the problems that

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were encountered on the way. In the first generation, these problems were mostly technical: processing and storage capacity and hard copy quality challenged developers to realize systems that could outperform the typing room. The problem of determining and formalizing office functions other than word processing and document exchange hadn't emerged yet. As new generations evolve, the technical problems remain as developers explore the limits of state-of-the-art IT. But are these problems crucial to the success of office systems? We think not.

Today, still, determining the functionality of a text processor is not a crucial problem (although competing word processor manufacturers make us believe this isn't true), and the same holds for other "standard" office functionalities such as electronic mail, agenda management and those offered by "off the shelf" applications for computer supported cooperative work (CSCW). A decade of office systems literature[*] shows that the real problems lies in determining the office functionality for a *specific* organization. Scores of different (and often not so much different) modelling languages for specifying office procedures and systems have been developed. Yet there is little evidence of these languages actually being used. Why?

From the analytical perspective, office (system) specification languages make sense. Office objects can be identified and classified and procedures can structured to prescribe rational activities. Admittedly, many routine office procedures can effectively be modelled – and subsequently be automated. But procedure-oriented approaches to office system design get stuck when activities become less structured, or perhaps better: more *dynamic*. In a complex and turbulent environment, procedures will have to adapt to changing circumstances. As offices show more "second order" dynamics (Ramackers & Verrijn-Stuart 1991), office workers will more often have to define procedures as they proceed, a characteristic of unstructured

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[*] The proceedings of the IFIP WG8.4 working conferences alone constitute a fair-sized sample.

tasks (Simon 1977, Panko 1984). Office system models and architectures that are *not* procedure-oriented, such as intelligent form based systems, tend to get stuck in the lack of transparency and control. The problem with all office specification languages is that they can describe only the "primary" office work (i.e., the work that contributes directly to the organization's output) and not the problem solving and negotiation efforts that go into *defining* the office.

From the interpretivist perspective, these efforts are the main constituents of office work. But although the political, adaptive ("fluid") nature of office work is recognized, this does not solve the design problem. A design approach that effectively combines both perspectives, taking into account structure, dynamics and the adaptive and strategic human behavior, has yet to be conceived. Efforts in that direction are still rare, but gaining momentum (Van Meel, Bots & Sol 1995).

As even this superficial analysis shows, the technological dimension of the IOF constitutes a rich source of problems. The key problem for the technology providers will be integration. Integration of copying and communication technologies has resulted in the now ubiquitous fax, integration of computing and communication technologies has enabled EDI. There is little doubt that integration of information carriers (data, text, voice, image, video) and integration of different types of information systems (e.g. data bases and document management systems) combined with the further elimination of geographic distance will produce more generic functionalities. The integration of old and new functionalities in one user interface will constitute a major challenge of for multidisciplinary research by engineers, cognitive psychologists, etc.

The key problem for those who must turn these generic functionalities into productivity increase will be the design and implementation of office systems that really "work". And that is not an easy task. The progress made in information and communication technologies and the proliferation of these technologies in organizations are impressive. But more impressive

is the simple fact that, although the capital investment in technology has doubled since 1982, the productivity of office workers has *not* improved (Eason 1988, Markus & Connolly 1990, Roach 1991). To some extent, this productivity standstill may be attributed to the systems design and implementation problems we encountered in this section. More problems are likely to be found when investigating the IOF along the organizational dimension.

3. Organizational forms: How dynamic can you get?

It proves to be particularly difficult to predict *how* new technologies will affect organizations, and also *when* this impact will actually take place. In the early days of computing, it was generally believed that IT would restructure organizations, reducing or even eliminating middle management (Leavitt & Whisler 1958). A decade later, this theory was questioned, as middle management was still firmly in place, notwithstanding the massive amounts of IT installed (Davis & Olson 1984, p. 358). Another decade and the theory seems to be confirmed (Malone & Rockart 1991). The prediction that IT would reduce the paper flow in organizations shows a similar lag: In the mid-seventies, the "paperless office" seemed to lie just around the corner, while in the following decade ever more paper was used. The impact of advanced hard copy technology was felt earlier than that of paperless technologies, such as EDI, e-mail, databases and electronic document imaging. But now that these technologies proliferate, the paper industry is seriously bracing itself (Ashley 1994).

Though we may not understand exactly how or when, technology and organizational form are most certainly related. Malone and Rockart (1991) observe that IT is used first to facilitate existing coordination mechanisms, but then enable new (more coordination-dependent) ways of working. Different organizational forms go together with different technologies: adhocracies call for/are enabled by CSCW systems, while EDI enables/is required by organizations with a Just-In-Time philosophy (Van Meel, Bots & Sol 1995). The new organizational

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forms described in the literature have in common that they strongly depend on information technology (and, incidentally, support our view that modern organizations *are* offices). Huber & McDaniel (1986) picture post-industrial organizations as team-based, decision-focused and adaptive with dual structures for structured and unstructured tasks. The "cluster organization" as described by Applegate *et al.* (1988) is characterized by a flat, flexible, dynamic, project oriented structure, a combination of decentralized decision making and centralized control and highly autonomous workers (a study by DeLisi (1980) indeed shows that office workers today want more challenges, more autonomy and more involvement in decision making), often part-time. As Regan & O'Connor (1994) summarize, there is a general shift from hierarchical to flat, networked organizations. Problem solving and decision making in such flattened organizational structures will be done by teams that are expected to be ad hoc rather than standing. The role of the individual will change from subject-matter expert only to team member.

At this point, we may draw a parallel with our observations along the technological dimension. From an analytical perspective, the design of office procedures goes hand in hand with the design of office systems – for structured work! Even if the design problems mentioned in the previous section could be resolved, we're still stuck with the "truly" unstructured work Again, the analytical perspective has to yield to the interpretivist perspective when the social "arena" is an essential aspect of task performance. Formal procedures and technology may increase productivity for structured tasks, but they are secondary considerations when it comes to unstructured work, in particular the design of procedures and the implementation of supporting systems. For good reason, Charan (1991) pictures new, boundaryless organizations as *social* networks, rather than computer networks. The "primary" office work may be *performed* by IT, the goal setting, prioritizing, organizing, and negotiating can at best be *supported*.

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For the IOF to be successful, there are two basic organizational problems that must be resolved, and both have to do with dynamics. To cope with the increasing complexity and turbulence (and with the resulting increase of unstructured tasks), organizations must adopt a dynamic, networked structure that allows them to get the most out of the knowledge and skills of its members. To cope with the increasing hostility, organizations must adopt a process of "ongoing improvement" (Goldrath & Cox 1989), which means that they must create the appropriate culture and maintain this process, using short term gains as positive reinforcement to keep going and reap the long-term gains.

4. Internationalization: How to support torn organizations?

The difference between a national and an international organization is obvious. "International" means that it has to deal with more than one nation and culture. This applies to the environment of the organization and to the way people perform their tasks within the organization. Another aspect of internationalization is the bordercrossing, interorganiza-tional information exchange. What is the most dominant aspect of internationalization: cross-cultural, interorganiza-tional or environmental, and how can we deal with these aspects?

We shall illustrate the complexity, or the lack of complexity, that can be attributed to an organization's international aspect from an analytical and an interpretivist perspective.

As we stated earlier, an organization is seen from an analytical perspective as an environment in which people perform a variety of functions in a rational and purposeful way. This applies to both national and international organizations. The analytical perspective highlights the tasks that are being performed and the way in which they are structured. In this respect, the differences between a national and an international organization are limited to the language that is being used and the coordination mechanisms that are applied.

The use of different languages can easily be overcome. Several tools already exist in the field of translation. We assume that in the future it will be possible to adjust the language in which you want to receive your e-mail (Hwang 1993), regardless what language it originally was written in. We expect it to become possible to apply these tools to a wide variety of textual information.

Depending on the characteristics of the task being performed and the (dynamics of the) environment in which the organization operates, different coordination instruments can be used. Given the environmental characteristics of an international organization and the wide variety of different tasks that are performed within the organization, we expect that several coordination mechanisms will be applied in conjunction. When circumstances change from one location to another, the mix of coordination mechanisms will change. Each mix will result in a special set of demands on supporting tools. This makes it necessary to analyze the set of mechanisms that are actually used before supporting them with certain tools. In an international organization, this needs to be done locally.

Thus, from the analytical perspective, the "I" in IOF creates more work (translation and an analysis of more and diverse coordination mechanisms), but no new problems.

This changes when we look upon the IOF from the interpretivist perspective. Within the interpretivist perspective four aspects of an office are identified: the work role, the decision taking, the transactions and the language actions. To gain insight in the way offices function, and the circumstances that influence the way people their task, we should consult disciplines like sociology and psychology (Weick 1979). Krone (1987) for instance recognizes several factors that influence the effectiveness of communication within and between persons and organizations, e.g. the attitude, knowledge, and perception of an individual, the role a person has within the office, the shared meanings and values of people working within the office and

finally the context of the communication. These factors are partially determined by the prevailing culture.

Basic assumption of the interpretivist perspective is the relation between these factors and the way technology can be used to support office workers. We expect that within the IOF different cultures will be confronted with another, creating new cultures. The evolution of cultures will result in changing demands towards the supporting technology. This will make it necessary to gain more in depth knowledge about the relation between organizational cultures and the impact on the possibilities and use of supporting technology.

We can illustrate the differences in culture with respect to the inter-personal communication. The "distance" between manager and subordinate may widely differ from culture to culture. When people from different cultures get involved in direct communication, clashes may result. Good examples are the (internal!) consultant who is not expected to speak unless he (or she!) is asked a direct question versus the consultant who is expected to take the lead, and the executive who can be approached only through a sequence of intermediary managers. Imagine the consequences of these differences when implementing teleconferencing or even e-mail systems!

We expect that the internationalization of office activities will lead to more interorganizational cooperation and information exchange. Interorganizational cooperation compared with intra-organizational cooperation is more complex due to the absence of a single center of power, the absence of consensus and the presence of a large number of participating organizations. This results in different coordination mechanisms between organizations than within organizations (Lorenz 1988). The use of computer technology has a potential for usefully supporting coordination efforts within organizational networks. This potential can only be utilized when participants are reliable, motivated, have mutual trust, and when there is cooperation, creativity and prudent evaluation in the network (Ching 1993). With respect to the IOF, the central question is how to establish stable rela-

tions between participants that make interorganizational coordination possible and accepted?

In relation to the environment, "international" means that the organization has to deal with several national governments and legal systems. This affects all activities such as hiring employees, acquiring licenses, paying taxes, etc. It also affects the way in which computer technology can be used for supporting coordination. Some countries have legislation related to the use and exchange of data related to individuals and the use of technical standards.

We can illustrate the influence of the environment on the field of hiring employees and career management. In some countries it is common sense to have a collective labor agreement, minimum wages and employment protection. Other countries prefer to stimulate the flexibility of labor by avoiding regulation of the labor market. By consequence, the personnel policy of an international organization must be "translated" to fit the local policy. This complicates not only the intra-company coordination, but also the application of IT. When looking for ways to improve productivity, different constraints will apply to different subsidiaries, thereby changing the nature of this unstructured decision process. Such situation occurs for example when in one country the unions and the workers council must be negotiated with, while in some other country there are not even words for such bodies. How to cope with these differences implementing organizational changes when and designing systems?

5. Science or Fiction? An agenda for research

The analysis in this position paper may have been superficial, but it has at least helped in identifying a number of problems associated with the IOF. Along the technological dimension, fiction is gradually but surely becoming reality. Science will provide the answers to the problems of technology integration.

More fundamental are the problems encountered along the international dimension. The complex of factors related to the in-

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ternational dimension of the IOF has only been skimmed. The relationship between legal systems and the structure and development of organizations is but one specific topic. A large-scale, international comparative study into the man-labor relationship would be another such topic, and much more can be thought of.

Where the technological meets the organizational (and international) dimensions, issues like (international) legislation on electronic documents and signatures become relevant. But business is not likely to wait for legislation. It will continue on a trust basis, but clashes and suits and jurisprudence are inevitable, providing ample opportunity for research.

Most likely, though, research effort will focus along the organizational dimension. There is a growing need for adequate performance measures. Cost/benefit analysis of investment in new technologies is more difficult than ever, while measuring the productivity of knowledge workers is be essential in finding out what "works" and what doesn't. And how to create a suitable environment with incentives for spotting problems and opportunities and finding creative solutions? There should be ample opportunity to do empirical research into the effect of different reward systems in modern organizations.

The crucial problem, however, will be that of improving the productivity of information workers. Technology push and globalization will inevitably make the IOF the international organization of today. For those who want to gain advantage on the way, the "working smarter" principle put forward by Drucker (1991) may prove to be a good adagium to keep in mind: when re-engineering work, distinguish between performance in terms of quality and quantity. If quality determines performance, develop the art of finding out "what works"; if both quality and quantity determine performance, analyze the process step by step; if quantity is the main determinant of performance, apply conventional industrial engineering principles.

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The Legacy of "Task-Work": The "Office of the Future" meets the Factory of the Past*

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Dunce: The word dunce comes from the name of John Duns Scotus, an eminent thirteenth-century scholastic theologian. In the early sixteenth century the humanist scholars of classical Greek and Latin and the religious reformers criticized the Dunses, or followers of Scotus, for their resistance to the new learning of the Renaissance and the new theology of the Reformation. By the end of the sixteenth century dunse or dunce had acquired its current meaning "a stupid person."
(Word Mysteries & Histories, Houghton Mifflin)

Many, no doubt, recall that a name Frederick Taylor preferred to Scientific Management was "task management." Indeed, one could plausibly claim that the shift from product-centered work within a guild/craft system to task-centered work within a corporate/bureaucratic system represented the central axis of change between pre-industrial and industrial work practices. A key aspect of the production of the current industrial order has been the construction of task-based work systems. An equally important construction, less noted as a domain in itself, has been production of the task-centered worker. It is no exaggeration to say that, prior to the appearance of today's bureaucratized system of industrial relations, the main source of indus-

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* This contribution is largely based on the author's forthcoming book, *Management Knowledge in a Postmodern World* (Sage, London).

trial unrest was the unwillingness of workers to relinquish control of the production process and to accept task labor systems.

Today – especially in the most heavily-industrialized countries and increasingly elsewhere – task work has become deeply ingrained in both social "common sense" and in formal systems of knowledge development and application. Work systems, workers and knowledge about work have all been transformed into an interlocking industrial "reality". Whether one believes this to be a good or a bad thing is an important question, but one that is off the point of this position paper. I wish, more generally, to observe that this task-work based system does exist, that it is a way of understanding work and social life specific to particular cultures and a specific historical period and, most importantly, that this world view is increasingly a barrier to dealing constructively with the central problems of production and exchange in the industrialized world.

The call for a new type of post-industrial worker is becoming repetitious enough to have the quality of a litany. The new worker, we hear, will be a proactive problem solver, a self-managing team player, an abstract conceptualizer and a lifelong learner. Additionally, as long-term employment is announced to be a thing of the past, a new implied employment contract is being expressed in which it is said the worker of the future will have to be a mobile bundle of employable assets. In other words, task-centered thinking is neither appropriate nor advantageous – for employers or workers. Tom Peters' last two tomes have blasted managers on this count, as has Abraham Zaleznik (1989) in his attack on the "managerial mystique." Judith Bardwick has constructed a similarly vigorous critique of what she calls the "psychology of entitlement," which is a polemic against the task-work minded employee.

But are we blaming the victim? In the "office of the future", it will, no doubt be possible to find unproductively task-centered workers. In this sense, yes, we need to call for change. But where did this task mentality come from? What is keeping it in place? If we look at history, we see that it took generations to

produce a worker with a task mentality (Jacques, forthcoming). C. Wright Mills (1956) does an excellent job of showing how the logic of the factory was reproduced as the logic of the office (this is so even if one disagrees with Mills' value judgments regarding those changes). We also know from our studies of large social systems that when people persistently exhibit behaviors, those behaviors are being reinforced by the social context. If, tomorrow, every worker were replaced by a worker with a process-centered mentality, the system would re-create task-centered workers. Yet, many elements of that system have, to date, received very little careful, historically informed analysis. For instance:

- *Where is the quid pro quo for employees?* Historically, employees have not unionized to seek security so much as to seek control of the labor process. They settled for security. Management, industrial relations and organizational theory have participated in constructing the worker as task, rather than outcome, centered. Similarly, if employees are self, rather than group, oriented it is a reflection of cultural norms and organizational rewards. If we expect substantially different behavior from employees (and managers are also employees!), what would make it worth their while to change their perceptions and values?

- *Scientific inquiry as task-work:* Problems most amenable to scientific analysis are problems that can be disassembled reductionistically and reconstructed using mutually exclusive, exhaustive, hierarchical models (e.g., the periodic table; the evolutionary tree; the assembly line). To divide knowledge this way reproduces within "knowledge work", the task-environment of the assembly line. One problem is that scientific tools have been so successful in producing the modern world that it is easy to forget that they are just tools and, as such, are applicable to some, not all, problems.

- *Academia as a "Factory of the Mind":* Enter the school of management (as I did) with a problem generated in the world of work and you are likely to find that it doesn't fit. Activity

Based Costing? That's in the accounting department. Business Process Redesign and Total Quality Management? Check the production operations and industrial engineering people. Implementing change? Try Organizational Development. Motivation and leadership? Check the org psych and management departments. Ford Motor has moved beyond River Rouge, but in academia one must usually produce knowledge about the "boundaryless" organization from within a disciplinarily segmented knowledge factory.

- *Going "by the numbers":* Science is a knowledge system built on the measurable. So is finance and accounting. Day to day experience in offices is not so neatly bounded. Have we considered the degree to which a habitual reliance on the superiority of "bottom line", measurable information may reinforce an outmoded industrial reality? For instance, Fletcher (1993) found engineers expressing to her that they might know ways to best serve project development by communicating or helping others on their team but, since such activities were not measurable, and recognition was based on what was measured, they would be subordinating their own career development to the good of the project – which, of course, they were reluctant to do. This is especially important for information systems. To what extent will we design systems that assist people with recording and communicating what can be encoded; to what extent will we restrict office reality to what is encodable?

- *Reward Systems:* Based on the interventions I have been involved in and read about, one of the top reasons there are so many examples of TQM/CQI failures is that emphasis has often been placed on statistical sampling techniques rather than on creating reward structures to reinforce new ways of operating. Again, information systems have a key role to play. For instance, adding a new layer of reports while basing managerial bonuses on old data (e.g., output) rather than new data (e.g., customer satisfaction indexes) has been a common path to failure. But, how does one reward based on problems prevented, facilitation between functional divisions or sup-

port of others? These questions pose paradigmatic challenges to entrenched habits of thinking about the very nature of what constitutes work and value.

- *Contingency and Commitment:* Point: Workers have to stop doing simply what they are told, increase their job-relevant skills and invest more intelligence and emotional energy in their jobs. Point: The employment relationship of the future is going to be more contingent; workers are going to have to think of their jobs as temporary. There is considerable tension between these two points. It is relatively easy to design an office with future-oriented work flows and technologies. It is relatively more difficult to understand how we will (collectively) create an environment in which workers exhibit the attitudes and behaviors on which these new work systems depend.

If one looks, for instance, at the experience of the U.S. between 1870 and 1920, one can see that industrialization literally produced a new worker (Jacques, forthcoming). The employee of 1920, who expected to spend his or her life doing task-centered work for wages within a large organization would have been unable to communicate with the average worker of 1870 regarding the "natural" role of the corporation, task-work, wage labor, community relationships, or the rights and responsibilities of a member of society. As we look at the office of the future, perhaps we are attempting to squint across another divide of this magnitude. What we have yet to understand is that in the last transformation, religion, education, government and professionalism were themselves transformed through an "industrial revolution". That revolution did not simply produce the forms of management and professional knowledge we are used to today. It produced management and the technical professions de novo. Taylor's Schmidt, the R&D engineer and the management researcher are all birds of a feather in this regard. We were all hatched from the same brood in the nest of industrialization.

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As we face the next century, the logic of industrialism divides us at two critical levels. Within the organization, functional-area thinking has been the "common sense" of organizing since at least the 1920s. We are only occasionally capable of realizing in organizational real-time that there are no accounting problems, marketing problems, production problems, human resource problems, etc. Problems are inherently cross-functional. It is the logic of industrial thinking that (dys-functionally) divides the problem to suit the categories of the organization instead of the reverse.

The second level is a parallel division of academic organizational knowledge. We who produce knowledge about the office of the future are, ourselves, barely-communicating subgroups of industrial engineers, information systems specialists, human resource experts, management researchers, etc. We attend different conferences, write for different journals, form different consulting companies and are often bewildered by questions that are bread-and-butter to our colleagues on the other side of disciplinary walls.

In this regard, the example of the Dunsmen is apropos. Once the elite corps of knowledge producers in Europe, the Dunsmen retained an allegiance to the Scholastic philosophy of a theo-cratic/feudal order as the world moved in a secular, market-driven and increasingly technologically-intense direction. To-day the scientific moderns call the Scholastics "dunces", but what of the future? We can see that task-centered work prac-tices are giving way to something else, although what that something else may be is still unclear. But what of task-centered knowledge and knowledge producers? Can we be re-flective enough about our own assumptions, habits and institu-tions for creating and applying knowledge – or will we be the "dunces" of the next millennium? As Margaret Schaffner noted nearly a century ago, at the emergence of today's organiza-tional discourse, "no industrial relation can long survive the reasons for its being" (1907:132).

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Enhancing Office Systems with CSCW-Functions

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1. Introduction

1.1. Overview

Office Systems have gained a state of maturity in handling strictly defined business processes. But they show severe deficiencies. They are inappropriate for handling cooperation in general and they are not suited for the increasing numbers of "multi-site/multi-time/multi-culture workgroups" (section 1).

Hence fundamental requirements to be met by future Office Systems are discussed (section 2):

• First, average office work contains manifold situations of cooperation in general such as collaboration, brainstorming, negotiation, argumentation, group decisions etc. But, present Office Systems support mainly coordination work. It is important to overcome these intrinsic deficiencies and to broaden the scope of support to the whole range of cooperation.

• Second, the capabilities of Office Systems have to be improved to manage complex interactions as they appear in "multi-site/multi-time/multi-culture workgroups".

Section 3 and 4 consider basic concepts and sketch systems for Computer Supported Cooperative Work. Commercial CSCW products are discussed according to the following classification:

- Workflow Management Systems;
- Conferencing and Bulletin Board Systems;
- Information Filtering and Shared Calendaring;
- Meeting Support Systems;
- Whiteboard Software and Videoconferencing.

Subsequently, in section 5, enhancing Office Systems by specific CSCW functions is discussed. So based on the results obtained from several pivotal CSCW systems, auspicious and encouraging improvements for Office Systems may be predicted. There are four groups of possible improvements to Office Systems that will be considered:

- providing basic CSCW mechanisms;
- introducing additional features;
- models and theories governing interaction;
- establishing an interdisciplinary approach to design.

The literature on CSCW has increased rapidly so only some citations are given paradigmatically: proceedings of recent major CSCW-conferences (CSCW'90, '92 & '94; ECSCW'91 & '93), overviews of basic design concepts (Schmidt 1993, Shapiro et al. 1993a), presentation and evaluation of commercial products (PCM 1994, Byte 1994), and discussion of applications in office and administration (Shapiro et al. 1993b, PCM 1994, Glasson et al. 1994). It should be stressed that this selection is a subjective choice and mainly intended for providing a basis for further investigation.

1.2. Starting point: deficiencies of today's Office Systems

Present informatics is a victim of its success. There is a prevailing discomfort stemming from the fact that most of the "easy" things have already been done. This is especially the case with the computerizing of work settings that are most amenable to a closely-defined procedural approach: payroll, accounting, order processing, and further prevalent office procedures. This wide range of applications is constrained – on administrative, legal and organizational reasons – by highly formal, bureaucratic procedures and so predisposed to "programmed" solutions.

Hence, present day Office Systems apply procedural models and common databases to office work that consists of strictly structured tasks. There is no doubt that these systems have gained widespread usage – but below the surface of success there is a steadily growing discontent about these systems and their intrinsic limitations. Today's Office Systems are designed to help and support people in their work, yet somehow fall short of the common expectations. In some circumstances they can impede people's working practices or even fail.

2. Requirements of Future Office Systems

2.1. Requirement I: Broadening the scope of cooperative work

So the challenge is to move out from this base into the effective integration of separate systems, and into the support of "higher-level" organizational processes involving decision-making, negotiation and collaboration – areas characterized by flexibility and rapid change rather than constancy.

A closer inspection of cooperative work situations reveals that coordination is not "the only game in office". Coordinated work represents only one kind of the three major forms of cooperative work that comprises likewise collaboration and group decisions:

1. Coordination – the case considered in the widely used Workflow management systems – unifies different activities for the accomplishment of a common goal. Each activity is in an intrinsic relation to preceding and succeeding ones thus making synchronization a major issue.

2. Collaboration is the case of persons working together without external coordination as it is the case in co-editing and shared drawing. It is necessary to have a common information space and to point at a collective goal.

3. Group decisions need cooperation for the accomplishment of a collective decision. Although diverse opinions and interests may prevail, a minimum of mutual trust is required.

2.2. Requirement II: Enabling better interaction in "multi-site/multi-time/multi-culture workgroups"

Office Systems of the future will have to operate under circumstances that today may not be seen as common work environment: "multi-site / multi-time / multi-culture workgroups". With regard to this requirement, present Office Systems show big deficiencies that should be improved by adding specific CSCW functions.

Encouraging results from several CSCW pilot projects indicate better ways of interaction under such non-trivial work circumstances. Some projects should be mentioned as examples:

• One example is "intelligent" information sharing systems such as "Information Lens", "Object Lens" and "OVAL" (Malone). They are intended to have people who can manage their own e-mail. It also allows people to stay screened from junk mail. The system filters messages of interest, even when they are not directly addressed to specific users. In addition it provides capabilities for organizing mail based on various aspects of incoming messages. In working with semi-structured message templates, characteristics are established that would match corresponding interest profiles. Such categories might comprise organization, task, urgency, etc. A potential receiver may pose adequate rules for prioritizing incoming messages before reading and sort them into folders after reading them.

• "TeamWorkStation" (Ishii) pioneers a multi-culture setting for learning and discussion. The pilot version integrates two workplaces and connects them also with four video cameras directed at each workplace and each person at work. So ideal setting for distant learning is achieved, and that renders itself helpful even for different tasks such as acquiring the skill of Japanese hand printing.

• For scenarios marked by dislocated and asynchronous cooperation, the value of computer conferencing, whiteboarding, and videoconferencing has been shown by several projects.

So such products will be a helpful supplement for multi-time and multi-site offices.

Above examples may demonstrate the fact that CSCW functions are a necessary prerequisite for setting the stage for the "multi-site/multi-time/multi-culture workgroups".

3. Basic CSCW concepts

3.1. CSCW and Groupware

The term "Computer Support for Cooperative Work" was coined by Irene Greif and Paul Cashman in 1984, as a prelude to the first CSCW conference held in Austin, Texas (CSCW'86). CSCW was thought of as arising from a particular kind of problem – the need that most people had to cooperate in groups when doing their work. This gave rise to the need for particular kinds of software systems, to which the term "groupware" came to be applied.

Of course, systems have always been designed to serve many people. The distinctive feature being identified was that people liked to move to the workstation style usage. They cooperated on the same, or related, task by interacting with each other through the machine. So the members of a group were enabled to communicate with each other and to share their data. Cooperative work has particular features; thus, cooperative ensembles may vary over time. In addition they are marked by an ample local distribution and lack of central control. Likewise, work might be synchronous as well as asynchronous.

Systems were now developed conceived directly to support users in their inter-relations. This is a striking difference to the previous way of using the computer, when timesharing sustained the illusion that users had their own virtual machine entirely to themselves. It is not claimed that no previous systems ever did this, rather that explicit recognition of the needs of the users of such systems would now enter into the design philosophy.

3.2. CSCW as new application systems

The main CSCW application scenarios are the following ones:

- improvements to electronic mail functions (e.g. for forwarding, selecting, and storing messages);

- shared workspaces for providing common views on a particular subject;

- group authoring enabling collaborative writing with additions, revisions, comments, and annotations;

- group decision support systems for argumentation, negotiation, and decision making;

- meeting rooms, desktop conferences and computer conferences.

These CSCW applications have already reached the commercial enterprises. So a recent survey reviews more than one hundred commercial products (cf. section 4). There have been several driving forces spreading interest in CSCW. First of all, it is the normal and plain case that for achieving a task, people must work together. Furthermore, CSCW has to be seen as an enabling technology for reorganizing the commercial enterprise (Business Process Re-Engineering).

Other driving forces for the spreading interest in CSCW are connected to deficiencies of existing systems: dissatisfaction of the users with existing systems; increasing expectations of the users; "easy" things have already been done; concentration of existing systems on highly formal, bureaucratic procedures.

3.3. Taxonomy of CSCW

CSCW may be categorized according to various perspectives. One basic distinction – namely application scenarios – has already been used in the previous section. A prime categorization unanimously accepted is the distinction in place and time. According to a demarcation into same or different place and time, the following 3x3 technological square is yielded:

	same time	different time (predictable)	different time (unpredictable)
same place	meeting facilitation	work shifts	team rooms
different place (predictable)	whiteboarding, desktop or video conferencing	electronic or voice mail	collaborative writing
different place (unpredictable)	broadcast seminars	computer conferences	workflow management

Various authors have suggested further distinctions:

- The degree of communality is another factor which may vary. Communality may be the striving toward a common goal or a mere use of common resources.

- Further, there might be distinct ways of support such as overcoming obstacles, decreasing uncertainty, or providing active guidance.

- The restrictiveness of handling might be another perspective chosen which may range from rigidity to flexibility.

- Another form of taxonomy refers to media and structure such distinguishing between text documents, hypertext, multimedia, and hypermedia.

4. CSCW Products

4.1. Workflow Automation

A Workflow Management System is a system which provides procedural automation of a business process by management of the sequence of work activities and the invocation of appropriate human and/or IT resources associated with the various activity steps (definition according to the Workflow Management Coalition).

Marketing always has the need for catchy terms, therefore Workflow Management Systems are advertised as a revolution in the office world. In more humble terms, Workflow Management Systems would mean a shift in paradigms. Instead of regarding isolated departments, and their systems, as distinct

(ordering, accounting, etc.) the entire business activity is considered. So in workflow automation the existing LAN infrastructure is used to specify and coordinate business processes that move documents within workgroups. In this regard such systems are often compared with assembly lines for manufacturing.

There is a fast growing number of systems on the market: ActionWorkflow Manager, Archive Lite, Connect, IBM IMage-PLus/2, Keyfile, LinkWorks, Lotus Notes, Microsoft Electronic Forms Designer, WordPerfect in Forms, etc. The capability of most systems comprises such features as: systems installation, business analysis and modelling, Workflow creation, and performing different sub-tasks such as routing, exception handling, tracking, and reporting.

The systems are distinguished by distinct suitability to different tasks. Low-end-systems allow only very restricted definition of processes whereas their high-end counterparts provide a sophisticated functionality in various directions; e.g. routing, scalability, analysis, modelling and reporting capabilities. Notably, support for analysis and modelling of organizations and processes will render high-end systems very attractive.

4.2. Conferencing and Bulletin Board Systems

E-mail is the foundation of workgroup computing. No wonder then that these systems have achieved a high degree of maturity: CC:Mail from Lotus, Microsoft Mail, and Beyond-Mail get high scores. BeyondMail is esteemed highly for its perfected rule-based information handling and filtering.

First, Conferencing Systems or Bulletin Boards Systems (BBS) appeared soon after the emerging of e-mail in the late seventies. They were designed for dial in use enabling valuable support of remote users. They are often part of an office package, e.g. CC:Mail and WordPerfect Office.

Simple e-mail based BBS are only one side of the spectrum on the other side are intricate and elegant windows-based systems including administrative functions, conferencing and applica-

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tion integration. Most famous in this class is Lotus Notes which has become an archetype system.

4.3. Information filtering and shared calendaring

The filtering is aimed to screen people from junk mail and filter in messages of interest, even when they are not directly addressed to specific users. It provides capabilities for organizing mail based on various aspects of incoming messages. Working with semi-structured message templates, characteristics can be established that would match corresponding interest profiles. Such categories might comprise organization, task, urgency, etc. A potential receiver may pose adequate rules for prioritizing incoming messages before reading and sort them into folders after reading them. In practice it was often complicated to state rules a priori. So the system has evolved throughout use.

Many systems attempt to act as an intelligent substitute for paper diaries. In general it would seem difficult to replace paper diaries. The reason is that physical diaries are unsurpassed in several key terms: portability, flexibility and usage. Main advantages of paper diaries are the following: physical size and ubiquitous employment; ease of use and speed of handling; and diversity of annotations (clippings, post-it notes, inserts, different colors).

There are now many commercial products available that aim at replacing the paper diary. The major point for their use is not the individual need but the necessity to have scheduling capability in work group computing. Recent products are CaLANdar from Microsystems and Time and Place/2 from IBM.

4.4. Meeting Support Systems

First it seems necessary, to make some remarks on forms of support needed for conferences and meetings and their technical terms:

1. An early approach was given with Conferencing (or Bulletin Board) Systems. They aim at a continuous group conversation and mean unstructured information exchange within a group without any request for synchronicity.

2. Another early form of support centers on the scheduling issue. Although scheduling might be considered only as a preliminary stage or a problem of pure formal character, much attention has been paid to Group Scheduling Systems and Calendaring Systems.

3. Meeting Support Systems are directed at the central problem of the meeting and attempt to support the process itself. They sustain various sub-tasks: synchronous communication, setting of agendas, structuring of problems, evaluation of solutions, and facilitating of the discussion. Hence the particular venue of the meeting and its technical infrastructure are under consideration as well.

4. Whiteboard Software aims at viewing the same documents and discussing them. This is performed simultaneously. Such systems allow changing groups with attendees joining and leaving at their own discretion.

5. Desktop Videoconferencing is still in its infancy. If the capability of video is added, a higher level of technical communication infrastructure is needed.

The diversity of meeting packages is high with GroupSystems V from Ventana Corp. at the high end and VisionQuest for DOS at the low end.

GroupSystems V developed by Nunamaker has already merited its inclusion as a pilot project. It has one of the finest selection of group process tools and can be adjusted to various types of meetings. The range of its "idea" processing tools include idea generation, idea consolidation, alternative evaluation, voting, and reporting. Other support tools are concerned with meeting creation, agenda setting, and process facilitation. VisionQuest on the other hand is a low end product with an excellent usability/price ratio.

4.5. Whiteboard software and videoconferencing

Whiteboard software documents can be transferred and subsequently discussed, commented on and altered by other participants. In that way, adequate information sharing with close col-

laboration is set up. The demands on communication techniques are modest because of the restriction to have only still images. All in all, whiteboard software seems to be both an opportunity and a trade-off of the needs of CSCW given the conditions of communication lines which are available.

It is no wonder that the field is prospering. Commercial products vary in suitability: On the high end of the scale is Person to Person for Windows; whereas Intel Proshare, a system restricted to a two person communication, is on the low end.

Most systems exchange still images allowing only static document sharing and copying a still image of the counterpart, whereas more sophisticated systems aim at application sharing. Some systems work on normal phone lines but with possible major consequences for quality. An example for such a limited system is InVision.

If there are moving pictures being transmitted in videoconferences, an appropriate transmission is required. This means service based on digital exchange, e.g. ISDN, as a minimum requirement. An example for a high level product is Tele-media Personal Videosystems from AT&T. Despite bright prospects for the future, current usage of Desktop Videoconferencing is limited. Also, the look and feel of the systems in use is not very convincing.

5. Improvements to Office Systems

5.1. Improvement I: Providing basic CSCW mechanisms

In extending Office Systems particular CSCW mechanisms have to be provided:

• Sharing objects is a feature constitutive for CSCW. In principle a fluid transition between individual work and a cooperative work environment should be enabled. So, depending on the situation, different forms of sharing objects should be supported, such as real exchange of objects or provisions for the sharing of different views on a common object.

- Particular forms of integration have to be sustained. Especially developed for the application domain of office work are "office suites" that should support the fluent integration of cooperative and individual activities by virtue of their being an integrated software package. Such packages with Works from Microsoft and Lotus Notes as precursors provide integrated facilities for word processing, e-mail, retrieval, spreadsheets, etc.

- Several domain directories such as user directories and object directories have to be managed in every cooperative application.

- General services such as a common sharing and access policy and turn taking protocols should be built in.

5.2. Improvement II: Introducing additional features

Further desirable features to be provided are:

- Other features for sustaining coordination and decisions, including built-in "vote functions" as well as assistance for unanticipated use.

- Plasticity of mechanisms has to provide an adaptability to preferences. Mechanisms should be adaptable to personal preferences as well as to the wishes of a particular cooperating ensemble.

- Multidimensional aspects should sustain the various dimensions of articulation work. So indicators reminding the basic status such as what, where, how, when are to be managed simultaneously.

- Informal interaction is a prerequisite for mastering dynamic and complex settings. Mechanisms supporting the informal style of interpersonal interaction are best provided in a conference setting.

- Semantic conformity is desirable so that the semantic level of notational primitives should correspond to the context.

- In order to facilitate cooperative management, generic sets of interaction functions have to be built in between the layer of basic operation system and the application level.

- The context of information as well as the conceptual framework of information are of high interest. In office procedures, as well as in cooperative decision making, it is important to preserve the conceptual framework of information.

- Often it is necessary to stamp the originator of a certain information. In that way responsibilities can be accounted and biases can be controverted. In a similar way the persistence of context of information created will be essential.

5.3. Improvement III: Models and theories governing interaction

A lot of assumptions have been stated, various models have been developed, and some theories have been formulated. Partly they are aimed at understanding the nature of the interaction process, and partly they are intended to control the interaction processes:

- A wisely used theory touches at planning cooperation and is named Coordination Theory. According to Malone, Coordination Theory includes a number of principles governing the planning of activities with respect to their mutual dependencies.

- Another theory is aimed at structuring tasks by means of Articulation Work. Articulation Work, according to Strauss, points at the manifold mechanisms necessary in performing distributed work: divide, coordinate, allocate, schedule, connect etc.

- Stereotypes have been created in order to reduce complexity. They provide important mechanisms of interaction for coping with complex situations. Schmidt and Rodden cite the following ones: organizational structures defining roles, obligations, and entitlement; plans and schedules covering particular situations; standard operating procedures, e.g. processes defined in work flow management systems; conceptual

schemes comprising classification schemes, taxonomies, and thesauri.

- Supporting dialogue by artifacts is another focus. Already in common life, artifacts play a major part in everyday life. Their meaning is usually learnt gradually during basic education. Switching to an unfamiliar environment needs the creation, learning, and comprehension of additional artifacts. The pictograms in an airport may provide a good example for this necessity. In an similar way interaction via computers requires many artifacts to ensure comprehension.

- Modelling intelligent agents is governed by Enactment Theory. This is a very general theory on human agents and can be used in modelling "intelligent agents" in CSCW systems. Mahling proposes enactment chains concerning the following items: task initialization, planning and scheduling of tasks, task execution, and evaluation of task.

- Speech Act Theory is helpful in establishing a meta-dialogue on basis of the language/action perspective. Speech Act Theory was formulated by Austin and Searle and then used by Flores and Winograd in "The Coordinator" to build one of the first groupware systems.

5.4. Improvement IV: An interdisciplinary approach to design

But only adding one or the other theory might not suffice. It is an urgent necessity to bring together different scientific disciplines to a close cooperation in a common goal. To make such cooperation operational it is necessary to combine approaches and methods from a broad diversity of research fields.

In an interdisciplinary approach each discipline brings in its specific contribution:

- At first, CSCW is heavily based on the development of information technology. Thus, informatics with its various sub-branches is a dominant constituent.

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- As associate disciplines, operational research and systems sciences help to break down problem areas as well as domain structures and processes.

- Management sciences and its associated disciplines, e.g. organizational theory, come further in and help to incorporate an understanding of the social organization of activities. These perspectives may be concerned with matters such as structures and hierarchies, division of labor, organization of work, rules, and work practice. Also included is work practice with professional and organizational roles – be they formal or informal.

- Methods from ethnography enable us to characteristically improve work place analysis in non-trivial work settings, e.g. airports and fire brigades.

- Further there is an urging need to take into account the cognitive perspectives in the relationship between users and the systems. It is necessary to extend from the more easily appreciated requirement for the physical and perceptual usability of systems through to the cognitive ergonomics and to human computer interaction (also called HCI, CHI, or MMI).

- Organizational psychology is concerned with different matters including such examples as intellectual composition of groups, motivation to work, interpersonal factors like interpersonal skills and self-presentation.

Combining views and concepts of the different disciplines has been a permanent task in informatics. Already in the first approaches to information systems analysis and design, technology oriented approaches and organizational considerations had to be met. Yet it has been a long struggle until today's methodological landscape has been formed. Hence bringing together the concepts and views of such differing disciplines, as listed above, will be a major challenge.

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The Impact of Telecommuting
on the International Office of the Future

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In this paper, the concept of telecommuting is analyzed with specific reference to the place of work – home or non-home. Positive impacts and possible negative effects of telecommuting are discussed for home-based and non-home-based working environments. The concept of telecommuting is reviewed in terms of telecomputing. A model is proposed to describe a computing environment based on the location of computing resources involved. A three-dimensional space is defined to describe an organization in terms of place of work, level of empowerment of workers, and level of individual motivation. An attempt is made to explain the concept of telecomputing using the proposed model. Major considerations for developing a framework for the design of the "International Office of the Future" are identified.

1. Introduction

After the introduction of computers into business enterprises, over the last three/four decades, there was a revolutionary change in the way business functions are designed and defined. A new breed of professionals, viz. the systems analysts, came into existence to study, analyze, specify and document the business processes of an enterprise. Perhaps, the next major event

in this revolution is the evolution of "telecom-muting", which is prompting to redefine the business processes. Basic concepts such as employment, organizational structures, management styles, employee and employer expectations, business functions, etc. need to be reviewed in the light of telecommuting.

Telecommuting has far reaching implications on the social fabric of the society – to the extent of affecting the sexist stereotype definitions, encouraging single-parenthood etc.

Telecommuting makes it possible for individuals to time-share among different jobs/tasks, which affects the basic definition of employment which opens up a Pandora's box of other associated issues, such as legal, ethical, security, etc. Before we start a detailed discussion on these issues, let us look what we mean by "telecommuting".

There are several research works recently which discuss the meaning of "telecommuting" and its implications to organizations.

Gordon et al. (1990) define telecommuting as the practice of allowing a portion of the work force to spend some time each week working at home or elsewhere off-site, often linked to the office with a personal computer or terminal. According to Knight (1992), a telecommuter is any employee who uses a computer, telephone, facsimile machine, or any combination of the 3 to perform job duties and communicate with co-workers while away from the office. Telecommuting does not necessarily mean employees working at home. In the BC TEL program for example, workers report for work at a specially-established satellite office in a suburb rather than commuting to downtown Vancouver. At IBM, telecommuting employees report to the central office once or twice a week for meetings and messages (Cote-O'Hara 1993).

2. Impacts of telecommuting

Positive impacts of telecommuting are classified into three broad categories: organizational, individual and societal. The

place of work plays an important role in assessing the impacts of telecommuting. Whether the worker is working at home or in an intermediate place/satellite office has major consequences for the individual and for society.

(i) organizational

- staffing flexibility;
- cost reductions in office space and other resources;
- increased productivity;
- decreased absenteeism;
- more information turn around;
- enhanced reliability because information technology is used to move information, rather than people;
- hire people from less expensive labour markets for information/service based tasks;
- possible tax benefits due government policies to encourage telecommuting.

(ii) individual

- working at home is an opportunity to better manage family demands and schedule their own work;
- convenience in avoiding commuting;
- economy in saving work-related expenses;
- greater job satisfaction.

(iii) societal

- reduction in traffic congestion and air quality problems;
- decreased harassment/discrimination in office environment;
- decreased emphasis on CBD (central business district) leading to its decongestion;
- lower real estate values in CBD;
- well spread metropolis.

Some of the possible negative effects of telecommuting are:

- domestic interruptions and distractions when working at home;

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- loss of regular "contact" with management which is generally perceived to reduce opportunities for promotions, raises, etc.;
- perceived job insecurity;
- unstable work flow;
- managers' perceived loss of control or teamwork leading to more micro-management than MOB (management by objectives);
- pressures due to isolation;
- technical support;
- erosion in the sense of "belongingness" leading to loose coupling between employees and employers.

Proper choice of tasks, personnel and suitable technology may alleviate some of the drawbacks of telecommuting. Senior management should set clear goals for telecommuting, which should be in consonance with overall organizational goals and which instill confidence in the telecommuters that as much part of the organization as the in-house personnel. Personnel allowed to telecommute should be highly self-motivated, independent individuals who want to participate in the program, possess good time-management and organizational skills and who are consistently highly productive. Management should be trained and conditioned to treat telecommuters without suspicion and not to micromanage them. Telecommuters should not be made to feel that they are working on an island. Proper and regular communication channels and prompt technical support to telecommuters are vital to the success of telecommuting. A clear-cut telecommuting agreement with the employees helps remove "doubts" from the minds of employees and as well as, of managers.

A study by Cuban (1994) indicates that many companies are now trying to extend their network capabilities to include key people abroad or those just away from the office. It was identified that 4 typical groups of users benefit most from remote access to internal networks: small field offices not large enough to qualify for dedicated lines, business partners who could benefit from access to some, but not all, company network ser-

vices, the growing number of telecommuters, and nomadic users, which includes field salespeople and travelling executives.

Katz (1993) argues that the telecommuting trend would make today's office nearly obsolete. However, this will probably not occur because the need for personal interaction remains a driving force for future businesses. Telecommuters will be looking to take advantage of cheaper land prices to build on new subdivisions offering large homes. Telecommuting will stretch the outer reaches of most metropolitan areas.

3. Telecomputing

Telecomputing can be viewed as "computing using resources, including peripherals, a different site". Telecommuter is one who telecomputes to perform her/his tasks. In order to clarify the meaning of "telecomputing", let us look at more closely at what is "computing".

Elements involved in computing are conventionally a user, an I/O device, a processor (hardware), software and data. A model is proposed in this paper to classify different types of computing environments based on the location of the computing elements.

Computing element	Location					
Processor	1	0	1	1	1	P
Data	1	0	0	1	0	P
Software	1	0	0	0	1	P

An entry of "1" in the above table indicates the availability of "whole" amount of the computing element at the site of the user; it does not use off-the-site element at all. Entry "0" indicates non-existence of the element at the site – totally dependent on off-the-site elements. If it is the case of mix of local and remote resources, the entry is "P".

It is assumed that a user is equipped with an input-output device. The processor and associated firmware of the I/O device

is not considered as a component of the *processor* and *software* in the above table. The input device should be at the same location as the user. In most of the cases, at least one output device is at the user site.

111 Computing

This case is either stand alone computing or a centralized data base with all the users at the same site. This is not a case for telecomputing.

000 Computing

This is a case of telecomputing with no local processing power, data or software at all – a typical dumb remote terminal. Effectiveness of 000 computing depends heavily on the communication media capacity, traffic density, information loads.
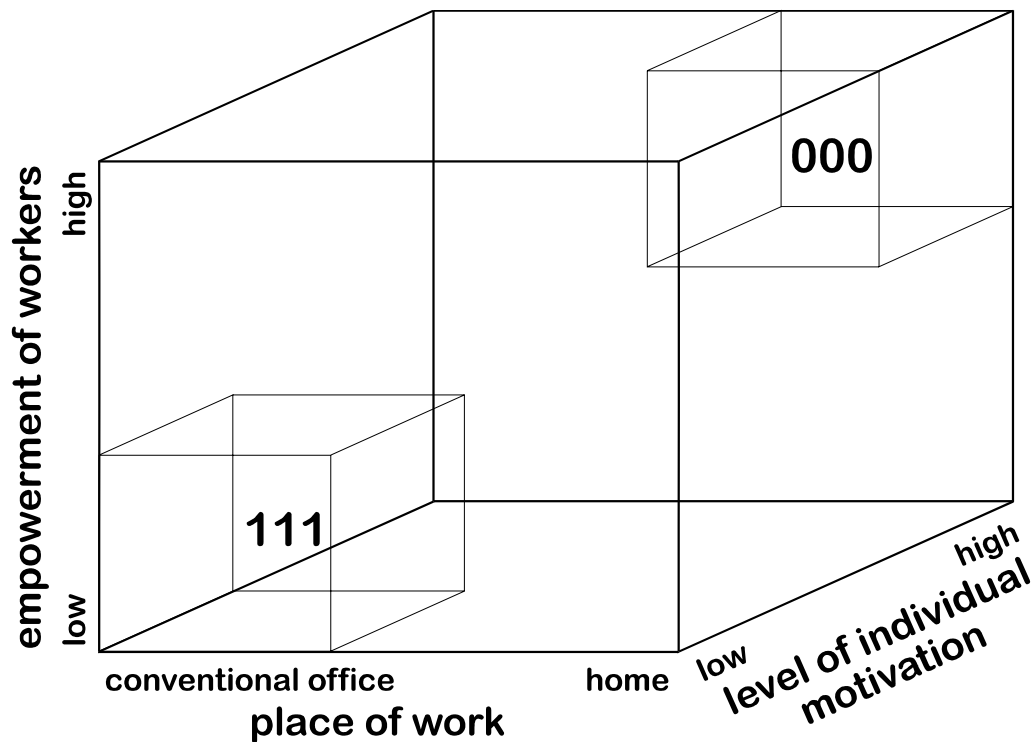
Some of the other modes of computing are listed below.

100   Remote terminal with local processing power;
110   Distributed data base system with centralized software;
101   Distributed processing with a central data base;
PPP   Telework Centres – Future Offices.

Excepting the case of 111, all other cases are examples of telecomputing. Depending on the nature of business, technology factors, etc., suitable telecomputing model needs to be chosen.

Telecomputing has facilitated development of several new business activities such as telemarketing, electronic publishing, distance education, etc. It has necessitated the redefinition of the conventional meaning associated with these activities.

The 000 computing environment is the one most appropriate for telecommuting. This model, as shown in the figure below, is characterized by minimal micro-management, and highly empowered, independent and motivated individuals

(Figure: three-dimensional cube diagram. Vertical axis labeled "empowerment of workers" (low to high); horizontal axis labeled "place of work" from "conventional office" to "home"; depth axis labeled "level of individual motivation" (low to high). A small cube near the origin is labeled "111" and a small cube in the upper far corner is labeled "000".)

4. Telecommuting and the IOF

Lucas (1994) argues that "... the design of information technology is the design of organizations ...". He has classified organizations, based on the IT design variables, into virtual, negotiated, traditional and vertically integrated conglomerate organizations. Future offices should support the requirements of future organizations and their structures.

In the model proposed above, the 000 environment is the most suitable for the IOF. Depending on the extent of empowerment of the workers, the degree of telecommuting and the level of motivation of the workers involved, each organization can be positioned within the three-dimensional space. Accordingly, strategies can be devised to migrate towards the 000 cubical space.

Future offices may not be offices at all, but their conceptual framework needs to be based on the following considerations.

- There exists mutual trust between "employers" and "employees" – employee for her/his career growth and other benefits, and employer for productivity.

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- Organizations develop management styles based on trust and more autonomous decision making and train their managers accordingly.
- Individuals are responsible for their tasks and productivity.
- A single office may support many businesses.
- An office may be more for social and recreational activities than for official business, most of which can be handled by the information technology.
- A knowledge worker may share his time among several jobs/tasks.
- Business of an enterprise can be achieved through a cluster of agreements negotiated with other enterprises.

Most of these issues raise serious legal and ethical implications. IT, itself, can offer to mitigate some of these problems. Proper choice of tasks, personnel, technology, and management style is the key to success.

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Developing an International Office of the Future Vision Statement: Workshop I
Hamburg, Germany, August 1994

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1. Introduction

The first of two workshops aimed at developing a possible International Office of the Future (IOF) "vision statement" was held in conjunction with the IFIP World Congress in Hamburg, Germany, August 1994. During the morning session of the workshop, the four position papers contained in this monograph were presented. In the afternoon, a two-stage facilitated brainstorm session was held to surface issues, problems and opportunities with respect to the IOF. The agenda comprised the following steps:

(1) clarification of the workshop's purpose and format;
(2) first round (plenary brainstorm), addressing the question "What are the issues that come to mind when you think of the International Office of the Future?";
(3) second round (brainstorm in sub-groups), addressing the question "What opportunities, challenges or issues do you see emerging, or needing to be addressed as we move towards the International Office of the Future?";
(4) closure.

2. Plenary brainstorm: process and outcome

After a brief introduction by the facilitator, the participants were given some seven minutes to privately write down specific issues or questions with regard to the IOF. The facilitator then asked each participant in turn to voice an issue, which was recorded on a flip-over sheet visible to all participants. This process was continued for some 20 minutes. Table 1 shows the outcome with related issues grouped as far as possible to reflect the particular fields of interest that surfaced during this stage.

- non-technical purpose environment
- livable with good organizational identity
- a place where everyone of us can be maximally accessible or inaccessible whatever we wish
- a place where issues are addressed and non-issues are removed
- transparency of agenda-setting
- a place providing insight views of different actors/stakeholders
- will multi-media affect importance of physical sites as meeting points?
- global office $\Rightarrow$ global firm $\Rightarrow$ decide 24 hours a day, taking turns/working shifts? (3 CEO's)
- we must think about a synchronous work (time zoning)
- finding techniques for rapid and good procedural design (conceptualization, solution building) as an ongoing activity
- participative approach to planning and decision making
- decentralization and the IOF
- how to optimize work distribution?
- what kind of tasks to be incorporated?
- who defines these tasks, how constraining will these definitions be?
- how to train people for this?
- absence of bureaucratic structures
- melting boundaries between working relations
- impact of national policies
- different cultures
- awareness of participants' background
- different languages/translation
- interpersonal communication requires more than just vocabular translation
- mechanisms for cross-cultural creativity (remove inhibiting differences)

- facilities to deal with ambiguities between cultures (slang, cultural terms etc.) that could lead to misunderstanding
- managerial awareness of cultural differences
- is foreign experience prerequisite for functioning in an IOF?
- transnational workteam accessing best talent there is (wherever it is)
- global, open job market: opportunities and threats
- trust and negotiated arrangements (labor relations, owner trust, more contracts?)
- maximum personal flexibility required
- minimum transparency in promotion
- how to take champagne into IOF?
- technical advanced with high demandings towards workers
- improving IT productivity
- data, location and technology transparency
- ability to access and deliver information worldwide
- good screening $\Rightarrow$ no information overload
- intelligent agents
- global standards
- mechanisms for anonymity
- overselling of technology
- platform and facilities management: global infrastructure, distributed data and applications: who's owner?
- intelligent systems to manage rights and costs of systems (will change daily)
- interoperability with legacy systems

Table 1. Issues surfaced in first brainstorm round

3. Sub-group brainstorms: process and outcome

For the second brainstorming session, the participants were divided in three sub-groups, each of which was to focus on one of these three themes: *Technology*, *Business processes*, and *Organizational, cultural and social aspects*. These particular themes were chosen as focal points for the multi-site conference that will complete the IOF trilogy. Each theme will be addressed in particular at one of the three sites serving as major hubs: *Technology* at Tucson (Arizona, U.S.A.*), Business processes* at Delft (The Netherlands), *and Organizational, cultural and social aspects* at Curtin (Australia).

The process that was followed by each of the three sub-groups proceeded along the same line. The participants were given five yellow PostIt™ sheets upon which they could write down remarks in response to the question "What opportunities, challenges or issues do you see emerging, or needing to be addressed as we move towards the International Office of the Future?". The individual remarks were posted on a large flip-over sheet, possibly triggering new responses from other members of the sub-group. After some twenty minutes, the idea generation was halted and the participants were asked to cluster the ideas into as many categories as they saw fit.

The outcome of the three parallel brainstorm sessions is shown in table 2 below.

1.　Technology

1.1　Use of data
- data and decision visualization
- multiple media in parallel
- personal knowledge base
- new usage for present databases (schema integration and O-O systems)

1.2　Workforce
- finding engineers, designers with ISN, globalization experience

1.3　Standardization
- heterogeneous system design, location, platforms, O.S. and transparency
- the chaotic infrastructure of the distributed system (as Internet)
- how far can technology be standardized?
- new protocols and applications (as MPEG)
- how much can be integrated?

1.4　Mobility
- nomadic computing opportunity
- ubiquitous computing

1.5　Intelligent agents
- delegation to intelligent assistents
- computer assisted translation
- automatic translation

2.　Business processes

2.1 *Organizational structure*
- virtual company
- create good support functions
- recommended practice
- create link between processes and issues and control

2.2 *Tools*
- software tools to facilitate brainstorming

2.3 *Translation*
- automatic translation programs
- local language translation
- machine translation to allow uni-language discourse (no lingua franca)

2.4 *Measuring performance*
- design of monitoring processes
- determination of key performance indicators

2.5 *Need for face-to-face*
- reduced travel for brief meetings

2.6 *Requirements*
- ensure sufficient quality

2.7 *Create shared perception*
- facilitate group perception of entire proces
- ensuring common frame of reference
- involvement of managment

2.8 *Task/processes*
- re-design
- determining problems/tasks
- can workers define their own processes (in a network environment)?
- accelerating the process
- separate the routine & non-routine
- broad range of office activities

2.9 *Global*
- transnational operations
- 24 hours global operations
- decisions all over the world
- some procedures world-wide (one enterprise)
- united nations office (refugees, peace keeping, environment control, disaster response)
- around the clock logistics
- dynamic moveable office technology

3. Organizational, cultural and social aspects

3.1 Impacts time dimension

- which impacts are of transitory kind only?
- opportunity: information agents

3.2 Cross-cultural pluralism

- cross cultural-creativity
- managerial awareness
- multi-cultural-teams may reflect on one topic from totaly different point of view and thus provide for more detailed analysis, especially on strategic issues

3.3 Information overload

- a danger of unnecessarily complicated relationships/superfluous communicative acts
- more meetings, more transparancy/information

3.4 Technology demands on the participants

- communicating by picture and voice instaed of written documents or telephone calls
- technical advances with high demands on workers
- opportunity: arround the clock accessibility anywhere

3.5 Mutual trust

- trust and negotiated arrangements
- trust between emplyees and employer
- cross-cultural recruitment of employees

3.6 Structured issues

- organizations' structural stability
- flexibility in staffing
- foreign exposure prerequisite

3.7 Redefinition of social interaction

- challenge: development of social norms for (in)accessibility
- social interaction among employees to be promoted
- necessity to find new forms of "hand shaking"
- corporate belongingness
- communications in the IOF should be context-rich, especially with regard to positions and intentions of sender

Table 2. Outcome of the three sub-group brainstorms

4. Acknowledgments

session are included in table 3. We like to thank them for their input.

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Table 3. Workshop participants

5. Conclusion

The aim of this workshop was to obtain a first set of issues to explore the richness of the IOF concept. As the record shows, there was no attempt at synthesis beyond the simple clustering of ideas. Many of the remarks in table 1 and 2 will cause some eyebrow-raising, which is exactly what is intended. We hope that many curious and critical minds will take up the challenge of elaborating the IOF issues that were raised so far.

Developing an International Office of the Future Vision Statement: Workshop II
San Sebastian, Spain, September 1994

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1. Introduction

The second of two workshops aimed at developing a possible International Office of the Future (IOF) "vision statement" was held in conjunction with the IFIP WG 8.3 working conference – "Decision support in organizational transformation", in San Sebastian, Spain in September 1994. The workshop used a facilitated "brainstorming" format to draw out thoughts and suggestions from the participants. The agenda comprised the following steps:

(1) presentation of two IOF scenarios;

(2) clarification of the workshop's purpose and format;

(3) addressing the question "What do you visualize (or think of or imagine) when we speak of the International Office of the Future?"

- part 1 – private generation of ideas;
- part 2 – public airing of views and public collection of additional ideas;

(4) addressing the question "What opportunities, challenges or issues do you see emerging, or needing to be addressed as we move towards the International Office of the Future?"
   - part 1 – participants were asked to privately develop five or so suggestions,
   - part 2 – the participants suggestions were then clustered around five themes;
(5) discussion of the form the output from the workshop (i.e. this monograph contribution) would take;
(6) closure.

2. Initial Scene Setting

The workshop began with the airing of two alternate IOF "scenarios". The facilitator read the first scenario description and illustrated the type of office environment envisaged using overhead foil diagrams. The participants also had a copy of the text (see table 1). This same scenario was used in much the same way to introduce the first workshop.

Imagine a decision support meeting in the International Office of the Future:

As the participants arrive at their local conference room, the walls near the conference table light up with live video images from similar meeting sites at other locations around the world in reasonable proximity to meeting participants. Participants feel as if they are all present in the same room.

Following introductions, the group leader assisted by a "cultural broker" presents a decision support agenda that includes phases of electronically supported problem framing, creative brainstorming, information organization, consensus formation and generation of action plans. Group members are invited to present their opinions and participate in the discussions verbally as well as through use of a wide variety of technology interfaces including personal notepads, wireless digital assistants, and conventional laptop computers using electronic pens and voice recognition in addition to keyboards. Electronic "agents" directed by group members seek out relevant information that may bear on the topic at hand and help cluster participant comments

As the meeting draws to a close, some participants record on diskette information that they want to personally retain. Other participants send meeting information directly to their office computers. In addition, public information is stored in a team memory to be accessed and used by other stakeholders and in future meetings. Participants leave the meeting with a sense of accomplishment, commitment, and personal satisfaction in the meeting process and product.

This is one of many examples possible in the International Office of the Future (IOF). And as we contemplate this and other visions it causes us to ask questions like: Will the IOF be a space rather than a place? Will it be shaped by available technology or will it demand the development of new ones?

Table 1. IOF Scenario 1 (adapted from Vogel 1994)

The second scenario was introduced via a short (12 minute) video (QPSX 1993). The first scenario focused on future group work and group working environments. The second focused on the telecommunications infrastructure that would support future office work. The two contrasting scenarios were intended to alert the workshop participants to possible future office opportunities and challenges and to stimulate their thinking prior to the brainstorm proper.

3. An IOF vision

The brainstorm commenced with the participants being asked to consider the question "What do you visualize (or think of or imagine) when we speak of the International Office of the Future?" They were given some seven minutes to privately generate their thoughts. Then these thoughts were collected in a series of "rounds". The round commenced by taking the first participant's first thought and writing it up on a public list. The next and subsequent participants were asked in turn to add one of their thoughts to the public list provided that the idea was not already on display. This process was continued until all the unique ideas were displayed. The process took approximately twenty minutes. The outcome is contained in table 2.

- Shared knowledge of product creation
- Internationalization of people
- Eliminate dead (i.e. waste) time in decision making (e.g. travel etc.)
- Portable office (e.g. satellite connection)
- (Database) Attribute inertia
- Realization problems
- Change in division of labor correlated to Information Technology
- Change in working procedures
- Change in office environment (e.g. lights, plants, desk)
- Asynchronous work
- People to people communication problems learning curve
- Elimination of offices/personal contacts
- Increased leisure time
- Cultural sensitivity
- Ergonomics
- Systems aids cultural learning
- More Information Technology skills
- Telecommuting
- More enriched communications (i.e. multi-media)
- Problem of over-control
- Transparent remote portability
- Risky environment
- Environment not conducive to informal communications
- Information overload
- Assumed understanding
- Voice control and personal note pads
- Routine inter-organization document and image transfer
- Support for accomplishment of personal or trade dictionaries
- Access to flows of information
- Staff motivation
- Physical limitations on sensory perceptions
- New "yuppie" elite (i.e., those with the skills to work in this new environment)
- Emotions networks
- Simultaneous translation
- Jurisdiction of power assignments
- Systems re-ordering information
- Enter into system whenever you want
- Information cross-checking
- Visualization of ideas in making

Table 2. Unique responses to question 1

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The list of unique responses to the first question was kept in full view while the group turned its attention to the second question which was "What opportunities, challenges or issues do you see emerging, or needing to be addressed as we move towards the International Office of the Future?".

Each participant was given five blank PostIt™ note slips. They were asked to privately generate five responses to that second question. The private generation of ideas took approximately seven minutes.

These individual responses were then made public and clustered around three initial themes, which the participants broke down into sub-themes. The procedure followed was to invite the participants to "post" their five suggestions on the most appropriate of three public lists – headed Business Processes and Work Practices; Technology; and Organizational and Social Aspects.

Then the participants re-arranged the suggestions into logical sub-clusters under emergent sub-themes. The outcome is shown in table 3 below.

1.　Business Processes and Work Practices

1.1.　Developing New Work Practices
- New working practices
- Flexibility in changing business
- Which problems are suitable?
- Reduce unproductive activities
- Relevant activities
- Need to trace back origins and backgrounds of an idea (proposal etc.)
- What is the relationship between observer and context
- Infantile contribution

1.2　Reliability
- Sod's law e.g. bandwidth, bottle-necks
- Usability
- How to cope with the coordination of consensual behavior

1.3　Democracy and Access
- Democratic access
- Pluralistic ways of work

- Hacking, misuse and data theft
- What will the differences then between having an office if one could conduct work from home?
- Improve shared knowledge creation of organization and inter-organization process
- Globalization of business activities may have impact on different societies
- Increase the communicative process between people ad societies when it is otherwise difficult
- Homogeneous cultural aspects

1.4 Cost and Benefits
- Cost benefits
- Funding

2. Technology

2.1 Protocol Design
- Widely recognized transfer protocols
- Security protocols
- Information security
- Data security and transmission
- No legal body to act in

2.2 Access and Exchange
- The quick access to the information about the latest innovations
- Problem of resources funding – network and machine capacities etc.
- Very consuming technology
- Historical memories (representing different views)
- Oblivion
- Better mass DBMS and access search technology
- Exchange of information and exploration

2.3 Globalization
- Make technology work global
- Platform around the world
- Develop "universal" communication infrastructure
- Business possible very far away and soon
- Miniaturization and telecommunication – portability and being independent from location

2.4 Supporting Humanness
- Intelligent environment
- Heterogeneous sophistication of nodes
- Space for reflection

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- Linking interpretations, perceptions and assumptions to data/knowledge
- How to cope with emotion network from technology
- Improvement of skills
- Presentation issues

3. Organizational and Social Aspects

3.1 Human Aspects
- The whole idea leaves me cold. Can I get off the boat?
- Freedom to act
- Place for people
- Are not workers to find that everything else in their work must also be developed
- Friendly environment
- Lifestyle to be congruent with a desirable human ideal
- How to cope with emotion in order to improve the conditions of poor people of their respective countries
- How to maximize opportunity for informal communication when technology implicitly formalizes
- structures
- Increased needs for off-line meetings
- Support human resource
- Cultural index change in order to create a world-wide cover

3.2 Ethics
- Privacy, intrusion
- How to make IOF human-centered not technocentric
- Secrecy to be watched
- Personal control and Big Brother effect
- No more work time versus free time
- Global understanding
- It may harshly affect other societies and makes them very poor and there is a need for a code of ethics
- Language, culture, trust
- Will it benefit the quality of working life?
- Who participates and who doesn't?

3.3 Organizational New Challenges
- Idea connections
- Knowledge ownership (between organization and overtime)
- Cognitive maps of meanings
- Over-control of employees through technology

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3.4   Organization
- Organization structure
- Goals
- Immediate demands to respond without time to think
- The agenda of the meetings – whose agenda?
- Instant access to rich data
- Information needs

3.5   Social Consequences
- Over dependency on technology
- Propensity to social insanity
- Human relations
- Challenge true international understanding
- It changes the life of a lot of people on the earth
- Threat of local cultures, language
- Global consequences
- Threat by religious institution
- They who have the information will have most of the power

3.6   Other
- Opportunity to bring satisfaction to human endeavor
- The challenge of maintaining individual, regional and national attributes in light of the move towards globalization
- Differences from living-settings
- Access to "everything" and "everybody"

Table 3. Clustered responses to question 2

4. Acknowledgments

The names and affiliations of the WG 8.3 conference attendees who participated in the brainstorming session are included in table 4. We would once again like to thank them for their cooperation during the session and for their contributions to it.

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Table 4. Workshop participants

5. Conclusion

The aim of this workshop was to develop another set of insights into the possible ramifications of the IOF concept. Again, there was no attempt at synthesis beyond the simple clustering of ideas, as the paper's purpose in the monograph is to cause others to think about possible futures. Its purpose is to open up discussion and debate. The time for conclusions is still a long way off.

6. References

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