Temporal Implications of Electronically Mediated Business Procedures on Organisational Work: EDI Applications in Trade

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"The computer is the contemporary analog
of the clocks and steam engines of the previous six centuries;..."
(Bolter, 1984)

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ABSTRACT

The thesis begins with the sociological proposition that time is socially constructed. As such, time interacts with, and is affected by anything that makes up the social world. Information technologies have become an essential element of contemporary organisations. This is a study of how information technology affects the temporality of work in organisations.

To address the question, we conducted case studies in organisations where temporal impacts of KTNET, an EDI application, were investigated and their sociological and organisational implications were analysed. Six dimensions of temporal order (duration, sequence, temporal location, deadline, cycle and rhythm) were employed to describe temporal changes in the work under study. Five major findings emerged from the case studies.

- KTNET increased the flexibility in some export administrative work.
- The distinction between internal and external flexibilities was more difficult to discern than expected.
- KTNET increased the polychronicity of some workers in organising their work time, which contradicts the result of a previous study; close scrutiny of the two results leads to the theory of a temporal symmetry in which information technologies provide a temporal symmetry either between temporal behaviour of events/tasks and temporal behaviour of workers, or between different work groups' temporal behaviour.
- KTNET tended to affect social relations between individuals or functional departments.
- Finally, new temporal adjustments, especially of temporal location, were made between transacting organisations.

The study increases knowledge in information systems research by raising a fresh issue of how computers affect temporality in organisational work and initiating a study on cultural impacts of information systems which could be applied in practice. It also makes contributions to management and organisation studies on temporality by devising a new classificatory scheme of studies on time and building a theory of temporal symmetry.

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PART I.

Time and Information Technologies: A Theoretical View

Part I sets a theoretical foundation for the thesis. Chapter 1 introduces the theme which this thesis is going to address. First, we discuss why the relationship between time and information technologies becomes an issue of serious inquiry in contemporary society. Then the social construction of time is explained and an analogy is made between mechanical clocks in the seventeenth and eighteenth centuries and computers in this century. In the following section, the origin of the research is presented in a wider context of studies on cultural impacts of information systems. Chapter 2 reviews the literature on time in management and organisational studies. Chapter 3 provides the dimensions of time which will be used as references in addressing temporality empirically. Then the research method employed is described and some issues regarding organisational and social implications of changing temporalities are presented.

Chapter 1
Introduction

A. The Relationship between Time and Information Technologies

1. Information technologies affect time

We live in time. Time is the most fundamental dimension of human existence along with space[1]. It is a foundation on which social orders are built. No social activities such as meetings, lectures, conferences, parties, etc. could take place properly without time being agreed upon among participants. "Shared concepts of and ways of mutual interaction in time are essential to social order and to the survival of any organisation" (Starkey, 1988, p. 100). Despite its fundamental nature, we often do not recognize it and we rather consider it as taken-for-granted. Our life is so firmly embedded in time that we are not aware of it.

In addition, as will be explained in detail later, time is social. It is not purely natural and given. It is as social and cultural as anything else such as rituals, customs, food and so on. Heavenly bodies move regularly in fixed periods of time; the earth runs round the sun and rotates on its own axis completing regular cycles. However it is human affairs that interpret and measure those movements into the calendar year and the day. Despite the fact that most calendars are based on the heavenly movement, people have had different calendars in various places through history. For example, the cyclic movements of the heavenly bodies led people to believe that time is circular because the sun, the moon and other stars have their own cycles in their respective movements. Time was inseparable from the circular movements of the heavens and therefore they believed that history was also cyclical and repeated. This cyclical idea of time and history is still well shown by the sexagenarian cycle in the traditional Chinese calendar, a nomenclature system of years, in which each year is given its own name which returns every sixty years.

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[1] Developments in physics in this century since Einstein have led scientists to believe that space and time are one entity, spacetime, not two separate ones (see

It was the Judaeo-Christian tradition which caused fundamental changes in the cyclical concept of time (Coveney and Highfield, 1990, p.26). Christianity established the linear (irreversible) concept of time, which has since dominated ideas of time in Western culture. The Christian belief in the birth and death of Christ and the Crucifixion as unique, unrepeatable events made people to regard time as a linear path that stretches between past and future. The Gregorian calendar, which was named after Pope Gregory XIII and which is the prototype of the modern calendar as we have now, does not have a cycle such as a sexagenarian one. In this calendar, years progress endlessly. Now they are getting closer to the year 2000, the new millennium, with a vision of a new century full of progress. Linear, irreversible time profoundly influenced Western thought. The views of history such as the progress or development of society and Darwin's theory of evolution, which have been foundations of the unfolding of the Western world, can trace their origin in the linear concept of time. In brief, the same movement of the heaven produced different calendars and different concepts of time and even history in different eras and different areas.

Anthropologists talk about 'other times' which deviate from Western ones (Adam, 1994) and report various time-reckoning systems within different cultures, societies and historical periods (Evans-Pritchard, 1940). Contrary to a variety of time-reckoning systems, the fact that we have the international standard time (Greenwich Mean Time[2]) to which local times in the rest of the world are compared shows another decisive aspect of the social nature of time. The birth of standard time is also attributed to the development of railway

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Chapter 2). The concept of space-time is recently being applied to sociology in studying social systems (Domingues, 1995).

[2] Actually GMT is not displayed on any clock. GMT is based on the earth's actual rotation. However the earth tends to slow down because of its molten core and oceans. It is so poor a timekeeper that a new standard is required. International Atomic Time (TAI), which uses as a reference the frequency of the microwave radiation emitted by atoms of caesium-133 (9,192,631,770 cycles per second), is the time standard maintained by the International Weights and Measures Office in Paris. An extra second, called the leap second, is periodically (no more than once or twice a year) added to atomic time to create Co-ordinated Universal Time (UTC). UTC has replaced GMT as the universal standard of time and is the time used by the BBC for its 'pips'. Interestingly, when we visit the Greenwich Royal Observatory, the time printed on tickets is not GMT, but it is in fact UTC (Hawkes, 1997; *Compton's Interactive Encyclopedia*, 1995).

transportation and telegraphic communication from which the need arose to synchronise different communities and countries with one another (Zerubavel, 1982). Apart from time-reckoning systems, our experiences in everyday life also tell a similar message. For example, words such as 'late', 'on time', 'punctual' and 'prompt' have different meanings and different scales depending on places, situations and organisations. While we do not consider it as 'late' when we are late to a birthday party by ten minutes, it is definitely defined as 'being late' when we arrive at a job interview only five minutes late. It might give a negative impression to interviewers and they could fail you only on the basis of 'being late', other things being equal. Somebody may not agree with the statement that time is social. However, to say the least, time is socially constructed as much as it is determined by nature.

We also live in a world where information technologies[3] and information systems[4] are changing every aspect of our life. They have become an essential part of our everyday life. Not a day of our life passes unaffected by computers. Even our domestic life is affected by personal computers and increasingly by the internet, in both negative and positive ways. Nowadays almost all organisations in industrialised economies, large or small, public or private, use information technologies for their daily activities. No organisation could handle the huge volume of its business, properly perform normal business activities and therefore survive in today's competitive and fast changing environment without them. Impacts of information technologies on individuals, work groups, organisations

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[3] In information technology and information systems literature, singular and plural forms of information technology and information system are both used. I will use the plural form when I mention IT in general. The singular form will be used when I refer to a specific technology or system in a specific context. Sometimes, however, both of singular and plural forms, information technology and information technologies, are used interchangeably following a referenced authors' usage.

[4] As generally understood in the information systems field, information technologies and information systems are different concepts. While information technologies refer to computer systems as a machine, information systems are increasingly said to be social systems in which computer systems are but one element (Land and Hirschheim, 1983; Waema and Walsham, 1990; Walsham et al. 1990). However, both are sometimes used with a similar connotation in this thesis, especially when I quote other authors' work. For more detailed explication of information systems as social systems, refer to Lee and Liebenau (1996).

and further society are enormous. In a word, there is nothing at organisational, national, societal and global levels which is not affected by them.

From the first statement above that time is socially constructed, we infer that time is possibly affected by anything that makes up the social world. Because information technologies dominate the social world in our contemporary age, we can build a proposition that information technologies affect time, which is the starting point of this research.

2. How time is affected by information technologies

Once this possibility is established, from it arises a question, "how is time affected by information technologies?" In work places, they have incredibly speeded up the flow of work processes and, thereby, saved us an immense amount of time. However, that is all we know about the relationship between time and information technologies. We do not know what happens in that process other than speeding-up and time-saving. It remains obscure. Efficiency and speed are only some aspects of temporality. They "characterize the time values *of the modern age*", says Rifkin (1987, p. 3, italics in the original), though in a slightly different context. One of the main arguments this thesis makes is that we need to know more about the relationship if we really want to understand the effects of information technologies on society, and thereby grasp the essence of changing contemporary society toward 'the information society' whose nature is not much known yet.

An example is given based on the author's personal work experience. In 1990 when I worked for a marketing research company, I used a 286 personal computer for data processing. Suppose I had 1,000 questionnaires with 50 questions, it took overnight to run an analysis using SPSS. We started running the programme at 6 p.m. just before we left the office. The next morning when we returned to work, all the resulting cross-tables (by sex, age, education, etc.) were awaiting us on a printer, assuming there were no faults. In 1991, we began to use a 386 machine. Now we were able to conduct the same task plus a bit more including programming and preliminary data analysis in a working day

from 9 to 6. A year later when I was no longer with the company, they might have done the same job with a 486 machine in one or two hours, probably during lunch time. When I visited the company in Winter 1995 and talked with my ex-colleague, he grumbled that a pentium computer did not allow him to "smoke even one cigarette comfortably."

Although he might exaggerate the situation, what does this episode mean for him? To say that his productivity has increased to a great extent and to exclaim in delight how much the company saves in monetary value as well as in time value is too simple and trivial and tells us little about time and information technologies. It is mundane and banal, and everybody knows it. Such knowledge is not what the author is trying to gain through this research. We can imagine that computers in the above episode not only reduce the amount of time required for the task, but also change the whole relationship in which the worker is involved; his relationships with his work, his colleagues, his manager and even with the company. These changes in the relationships can be described and interpreted from the viewpoint of temporality. Computers also affect his perceptions of work, and his way of organising time. Despite the significance which time and information technologies imply, information systems research has only dealt with limited aspects of time. The author suggests that there are many other aspects which are worth considering and which have rarely been explored yet. We can learn more about information technologies by taking seriously more profound and interesting aspects of time.

As implied in the above, little research has been done in the discipline of information systems on the relationship between time and information technologies. When we review research on time in other areas, we find that time has been rarely explored in social sciences or in management and organisational studies, the latter being a neighbouring discipline of information systems. Studies of time are only found scattered in various disciplines of social sciences and some philosophical works[5].

[5] For literature of studies on time in detail, see Chapter 2.

Under this circumstances, Barley (1988) has a unique place in the study of temporality and information technologies. According to the literature review which was conducted for the thesis (Chapter 2), he first addressed the issue of how time is affected by information technologies. He investigated how the introduction of computerised equipment into radiology departments in hospitals altered the temporal order of the departments. He employed a dichotomy of ways of organising time from an anthropological perspective: monochronic and polychronic ways (Hall, 1959, 1966, 1983). In the former, people do one thing at a time while in the latter several things are done at once[6].

In Barley's work, he found that radiologists in the departments using traditional X-rays are often summoned by technicians seeking the assistance of the radiologist on duty as well as by physicians and colleagues requiring his consultation. The flow of a radiologist's day is fragmented into a large number of discrete events with a relatively short duration, in an unpredictable sequence, with a vaguely estimated temporal location and irregular rate. Accordingly they find it difficult to deal with one event at a time, and therefore operate in a polychronic way. On the other hand, technicians' work goes as exactly as dictated by a daily schedule of patient appointments, and they operate in a monochronic way. The two professional groups live in different worlds of temporality, in other words, in temporal asymmetry (Barley, 1988, pp. 126-127; Zerubavel, 1981, p. 64). For example, when a technician needs a radiologist, he often has to search around for the radiologist on duty and, even after he finds the radiologist, he waits because the

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[6] Hall found out, he wrote, that Spanish and Anglos handled time in radically different ways after he watched a Spanish businessman conduct business in a "public, everything-at-once, melange way" (Hall, 1983, p. 42). He added that the same pattern could be observed in Latin America as well as in the Arab world. As we can see in its origin, his main interest was to apply the dichotomy into the understanding of cultural differences among different countries or ethnics. Even he went further to the extent that he applied it into gender differences when he said that "(A)t the preconscious level, M-time is male time and P-time is female time, and the ramifications of this difference are considerable" (p. 49). Furthermore he added that while polychronic cultures are by their very nature oriented to people, monochronic time is oriented to tasks, schedules and procedures (p. 50).

The author takes Hall's point that there are two different ways of handling time. However, I neither agree with the argument that the dichotomy can be applied to cultural differences among countries and gender, nor do I accept the argument that polychronic time is people-oriented while monochronic time is task-oriented. They seem to be over-generalisations which have weak grounds.

radiologist could be on the phone, or consulting other doctors, or reading films. Technicians feel frustrated on such occasions and are discontent with their relationship with radiologists.

The computer-based equipment such as ultrasound and the CT (computerised tomography) scanner has altered the situation. For instance, when assigned to CT duty, the radiologists consult more or less exclusively with physicians who ordered CT or ultrasound scannings. By limiting the scope of the radiologists' responsibilities and by distancing them from other technologies, CT duty has changed the temporal order of radiologists' work; task duration is lengthened and the rate of task switching is slowed. Along with these changes in the structural aspects, the flow of the radiologists' daily activities has become closely tied to the ultrasound or CT scanners' schedule which shapes the temporal organisation of experiences of the technicians in charge of the machines. By monitoring the day's schedule and the progress of the technicians' work, radiologists could estimate the sequence, temporal location and rate of recurrence of his primary duties. Now the radiologists on CT duty can operate based on the schedule, that is, in a monochronic way.

Barley concluded that the new computer-based equipment increased the monochronicity of radiologists' work by restructuring the duration, sequence, temporal location and rate of recurrence of events in their working day. It also enhanced the symmetry of temporal organisation between radiologists' and technicians' work. His investigation does not cease here in these structural aspects of temporality. The increased symmetry contributed to the decreased conflict between radiologists and technicians, and changed the social relationships between them[7]. Barley tried to explicate changes in social relations caused by those

[7] Barley is not arguing that temporal symmetry is the main factor of changing relationships between them. The relationships in the new technical areas of his hospital cases are marked by greater equanimity and less conflict between the two professional groups than those in the traditional technical areas. He attributed the differences mainly to the fact that "new modalities initially level status differences based on distributions of knowledge" (Barley, 1986). However, he suggests that other aspects of the social order surrounding the new technologies also contribute to qualitatively different forms of interaction. Important among these other parameters are the temporal aspect of work.

temporal shifts between radiologists and technicians, and thereby to read interpretive implications of temporal changes.

3. The nature of the research

This research is stimulated by Barley's (1988) in a practical sense for empirical research. The stimulation in terms of the origin of research ideas comes from evaluation framing (Stamper, 1988), which is to be presented in section C of this chapter. My research is largely built upon Barley's framework of temporal analysis. It consists of four structural parameters of temporality at a basic level: the sequence in which events typically occur, the duration of these events, or how long each lasts, the temporal location or when events usually occur, and the rates at which particular events recur. At a more analytical level, it employs distinctions between monochronicity and polychronicity, and between temporal symmetry and asymmetry. Barley provides a reference for comparing results as well as a starting point for empirical research. However, this research was not designed to test some concepts and propositions from his study, either to refute or to prove them. The author considers the issue of time and information technologies to be embryonic. This research is designed to develop issues surrounding time and information technologies. It intends to extend Barley's study, enrich some concepts, and thereby provide later researchers with refined conceptual and analytical tools for deeper investigation of the subject.

This research aims to investigate time on its own. In most social inquiry time has been dealt with as a background against which social processes take place. For example, trends of certain processes *over time* or changes *over time* are typical themes of social inquiry. They do not consider time as problematic. Implicitly they assume time to be taken-for-granted and given. I regard them to be time-related research, not research on time[8]. While there has been much time-related research in social sciences in general and management and organisational studies in particular, little research has been done with time as its main subject. This is also true of current information systems research.

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[8] See Chapter 2.

In this research time lies at the centre, not on its periphery. I begin by raising a question about the concept of time, and problematises it. I investigate various aspects of temporality per se and do not examine something *over time.* Then I examine the relationship between time and information technologies, more specifically, how computers transform temporal orders of work, and thereby reshape our working lives in organisations.

B. Sociotemporality

1. Three forms of time

Before we go further, it is necessary to explain what is meant when the author mentions time, temporality, temporal orders and so on. According to Zerubavel (1981), there are three forms of temporal orders: physiotemporal, biotemporal and sociotemporal orders. For brevity, I call them physical time, body time (or biotime) and social time. The physical world has temporal regularities such as the alternation of day and night, the periods of the earth's rotation on its axis and revolution around the sun, and the waxing and waning of the moon. Physical time regulates the movements of heavenly bodies. There are also temporal regularities in the living world: relatively fixed durations of pregnancy periods, fairly uniform circadian rhythms which govern body temperature and menstrual periods. Many living things have an inbuilt sense of time. The human body is also governed by precise rhythms working in harmony; the sleep/wake cycle - 24 to 25 hours - is controlled by the brain; the body temperature is lowest between 1 a.m. and 7 a.m. and is controlled by the hypothalamus; the heart beats 75 times per minute for an average adult; the menstruation comes in a cycle of around 28 days; the kidney excretion of waste products reaches its peak during the middle of the day; the cell division is most active in the late evening; adrenal gland secretions increase before waking to prepare the body for the day[9]. Body time regulates the lives and daily functioning of organisms. Finally, events in our social world take place on a fairly regular basis. For example, we usually go to work or to school on weekday mornings, and most Christians go to church on Sundays. We celebrate

[9] From an exhibition room in the Old Royal Observatory at Greenwich.

New Year's Day on a particular day of the year. Social time regulates the structure and dynamics of social life.

When I use the terms of time, temporality and temporal order, I refer to social time, unless specified. This regulates the lives of social entities such as families, organisations, communities and societies. Whereas physical time and biotime have been fairly well explored by physicists and astronomers, and life scientists respectively, the fair degree of attention corresponding to the importance of social time in constructing our social life has not been given to its studies by social scientists[10]. This research is concerned with the sociotemporal order. More specifically it tries to illuminate how information technologies affect the sociotemporal order in work places.

2. The conventionality of social time and the social construction of time

Although we can distinguish the three types of temporality at an analytical level, the distinction among the three of them is not so clear-cut as described above. In everyday life, they are closely connected with each other. Consider, for example, the solar calendar according to which our social life is organised. It is an approximation of a physiotemporal order in which the earth revolves around the sun and rotates on its own axis. Our working rhythm in most cases approximately coincides with the rotation of the earth, which also corresponds to our physiological circadian rhythm. In a most simple way, the sun rises, we wake up and start to work, and our body temperature begins to rise; the sun sets, we stop working, go to bed and the body temperature begins to decrease. The day is both astronomical and bio-behavioural units, and a social unit. Not only does it mark one turn of the earth about its axis and one day-night, dark-light, sleep-wake cycle for the human (McGrath and Kelly, 1986, p. 37), it also marks the most basic temporal unit of social life. Hence it looks as if there exists only one temporal order.

[10] Anthropology forms an exception. When anthropologists study other cultures and (primitive) tribes, they typically include time in their ethnographies.

Despite the close connection among them, there is a fundamental difference between social time on the one hand, and physical and body time on the other. The former is distinguished by its conventionality from the latter two.

> (W)hereas the physiotemporal and biotemporal orders, for example, are natural and, thus, inevitable, the sociotemporal order is essentially a socially constructed artifact which rests upon rather arbitrary social conventions (Zerubavel, 1981, p. xii).

There is no inevitable reason that most of us have 365 days for a year, divide them into twelve months, into weeks of seven days, and further a day into 24 hours and so on. They are just a social product which mankind has developed throughout its history. Heavenly bodies move constantly and regularly, giving us a sense of time. To measure and interpret those movements is a human affair. Therefore, while researchers of the physio- and biotemporal orders take for granted objective qualities of time, students of the sociotemporal order doubt its objectivity, and are more concerned with its subjective qualities[11], that is, the meanings that people attach to it.

An investigation of the seven-day week system shows clearly the conventionality of time. We keep the rigid time unit of seven days called the week. Whereas the day, the month and the year approximate the cyclical movements of the heavenly bodies, we cannot find any natural inevitability which justifies the seven-day week system. The Bible is the only reference on which we can rely. In modern history, there were two periods when people tried to change the weekly system: after the French Revolution and the Russian Revolution (Zerubavel, 1977; Boorstin, 1983; Rifkin, 1987).

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[11] The subjectivity here does not mean each individual's subjectivity. Here lies the difference of the psychological concern with time from the concern with the sociotemporal order. The psychology of time also deals with subjective qualities of time. However it concerns "the way in which the individual perceives time" (Zerubavel, 1981, p. xii). On the other hand, the sociotemporal order emphasises the way time is perceived and handled collectively by families, professional groups, communities, organisations, or even nations, and with its functions in those social organisations. The subjectivity is understood as the opposite of 'natural' and 'given', and therefore as 'human'.

The leaders of the French Revolution established a new calendar system in 1793. One of the major reforms[12] in the French Republican Calendar (or the Revolutionary Calendar) was the replacement of the seven-day week with the ten-day cycle. The calendar was composed of 12 months, each containing 30 uniform days. The five complementary days were grouped together at the end of the year. Each month, in turn, was divided into three ten-day cycles called 'decades'. Each day was divided into 10 hours. Each hour was further divided into 100 'decimal minutes', and each minute consecutively into 100 'decimal seconds'. Sundays and the Catholic saints' days were abolished. Sunday was replaced by 'Decadi', which was celebrated only every ten days as the official rest day. This resulted in a considerable reduction of the total number of rest days[13]. The major thrust of the calendar reform was against religion. It was designed to get rid of any religious remains from the realm of social life. The reformers wanted completely to eliminate the Church's influences over the life of French people. They also wanted to build a new society in the name of science and reason. Decimal systems were adopted in the new calendar to represent the spirit of science and reason and to establish the legitimacy of the new system of units of time.

In 1929, nearly a century and a half later, a five-day week system was enforced by the Soviet Union partly for an almost identical anti-religion purpose, and partly for a more constant use of capital (Moore, 1963, p. 122; Boorstin, 1983). A workweek was 'staggered' to efficiently use fixed capital resources. All enterprises and offices stayed open daily without a general day of rest, that is Sunday. Workers had every fifth day off, so that one fifth of the employees were normally absent on any given day, which led to chaos in proper operations of banks, schools and administrative offices. Families rarely enjoyed the same rest

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[12] The other reforms which are not covered in the text are as follows (Zerubavel, 1977, p. 870);
i) The traditional Christian Era was replaced by the Republican Era, which began on September 22, 1792, the day on which the French Republic was founded.
ii) A new annual cycle was established. The 22nd of September was set as New Year's Day instead of the 1st of January.
iii) An entirely new nomenclature was introduced. The reformers renamed each day and month within the new calendar.

day for all members. In 1931, Stalin ordered a change to a six-day week with a common rest day, and finally in 1940 the seven-day week was restored with Sunday the rest day.

The two historical examples imply that the seven-day week is just a social and historical product. However the fact that both of non-7-day weeks failed to survive indicates that, "despite its arbitrary and conventional basis, the standard temporal reference framework is deeply rooted in the culture, and its considerable organizational and cognitive centrality to social life may account for the resistance to any changes made in it" (Zerubavel, 1977, p. 869).

From a more theoretical viewpoint, that is, the sociology of knowledge, Durkheim (1965), one of the founding fathers of sociology, argued that the origin of time is social. When he inquired into the sources of the categories such as time, space, cause, number, etc. which the human mind possessed, he stated;

> Not only is it society which has founded them, but their contents are the different aspects of the social being; the category of class was at first indistinct from the concept of the human group; it is the rhythm of social life which is at the basis of the category of time; the territory occupied by the society furnished the material for the category of space; it is the collective force which was the prototype of the concept of efficient force, an essential element in the category of causality. However, the categories are not made to be applied only to the social realm; they reach out to all reality (1965, p. 488).

He emphasised time as a collective phenomenon - as a product of collective consciousness. Time is not, as Kant's 'apriorist' theory of knowledge suggests, a universal category inherent in the mind. It arises essentially from the experience of the collectivity. All members of a society share a common temporal consciousness; time is a social category of thought, a product of society. Society provides a framework according to which time is arranged, and crucial elements of this framework in modern western society are work and the clock (Blyton and others, 1989; Hassard, 1989, 1990, 1996; Pronovost, 1989; Zerubavel, 1977, 1979).

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[13] This is said to be one of the reasons which can be attributed to the failure of the calendar after 13 years in 1805. For other reasons, see Zerubavel (1977).

3. Clock time and the significance of clocks

To understand the significant roles that the clock and its product, clock time, have played since its invention and widespread use, especially in building modern western society, will give another explanation of the relationship among the three basic forms of time. It also presents a clue to understand why information technologies can be an issue as regards time.

It is generally accepted that the first reliable[14] clock was invented by Christiaan Huygens in 1657: a result of successfully using the pendulum in clocks. Before this mechanical clock which used the regular swing of a pendulum, there had been many types of clocks such as sundial, water clock (clepsydra), hourglass (sand clock), fire clock (using candles or incense sticks) and so on. Compared with them, the mechanical clock, which had developed from longcase pendulum clocks to wrist watches, was incomparable in accuracy. Furthermore, most other clocks could be used only for time measurement, what is more, for measurement of a short period of time. The sundial was available for both time-reckoning and time measurement. But it had an unresolvable limit; the sun does not cast a shadow at night. The mechanical clock was able to overcome both the limits. It can be used for measuring a relatively long period of time without any distinct interruption, day and night. It is also reliable as a time-reckoning method once it is set, for example, at noon, the moment when the sun reaches its highest point and crosses the local meridian.

The fundamental and essential difference between the mechanical clock and other clocks is to be mentioned. Before the mechanical clock, time had always been measured in relation to physical and biotic phenomena, that is, to the rising and setting sun and the waxing and waning moon, the periodic movements of stars[15], the changing seasons, the growth of plants and so on. Time was also associated with human activities and events such as daily work rhythms and

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[14] Before 1657 clocks could not keep time more closely than to about fifteen minutes per day; within twenty years they could be relied on to vary by less than ten seconds per day (Macey, 1980, p. 33).

[15] The race between astronomical and mechanical ways of solving the 'Longitude problem' in the eighteenth century is well described in Sobel (1996). In the problem of those days, time was longitude and longitude was time.

harvest, which relied on nature. People woke up and started to work when the sun rose; they stopped working and began to sleep when the sun set and darkness fell; they enjoyed harvest festivals when crops grew ripe and trees bore fruits. Then "time was not something fixed in advance and divorced from external events" and with the appearance of the mechanical clock, time now became "a function of pure mechanism" (Rifkin, 1987, p. 85). People wake up when the clock strikes seven, not when the sun rises; they work nine to five, not while the sun remains bright; they eat when prompted by the clock, not when they feel hungry; they go to bed before midnight, not when it is too dark to do something; people increasingly enjoy New Year's Day on the 1st of January, which has nothing to do with harvest. Therefore some historians of civilization said that it was the clocks that "dissociated time from human events" (Mumford, 1934, p. 15) and "human events from nature" (Landes, 1983, p. 16). The summer time system (or daylight saving time) presents a good illustration of that dissociation. Under the system, we reset the time on the clocks usually one hour ahead of the standard time (Greenwich Mean Time in Britain) which mainly relies on the earth's natural rotation so as to make better use of daylight hours. Why do we change the clock time? If the sun rises earlier, isn't it better and simple to get up and start to work earlier? We cannot do that simply because we have been firmly conditioned and socialised to start working when clocks strike nine o'clock. In brief, social activities are not regulated by physical time any more, no less by body time. They are governed by clock time. It is the clock that has separated social time from physical and biological times.

In the above, we have learned that the clock severed time from nature, and distinguished social time from physical and body times. The clock is a tool for measuring time. Its impacts on human life and civilizations, however, are enormous. Mumford insisted that "(T)he clock, not the steam-engine, is the key-machine of the modern industrial age" (1934, p. 14). He explains;

> In its relationship to determinable quantities of energy, to standardization, to automatic action, and finally to its own special product, accurate timing, the clock has been the foremost machine in modern technics: and at each period it has remained in the lead: it marks a perfection toward which other machines aspire. The clock, moreover, served as a model for many other kinds of mechanical works, and the analysis of motion that accompanied

> the perfection of the clock, with the various types of gearing and transmission that were elaborated, contributed to the success of quite different kinds of machine (p. 15).

Thompson (1967) also showed that the shift in time sense caused by the clock affected labour disciplines, and further contributed to the shaping of the industrial capitalism, and conversely that new capitalist manufacturing systems made use of the clock and the clock time to discipline workers and internalise these work disciplines. In that process, the 'task-orientation' of time organisation in which work proceeds to 'natural' rhythms (think of labour from dawn to dusk in a farming community) gave way to 'labour timed by the clock' (pp. 59-60). One of implications which we can draw from Thompson's study is that capitalist work disciplines were shaped at least partly by the clock.

Macey (1980) insists that the English supremacy in the horological revolution of 1660-1760 contributed greatly to the English industrial revolution, which is usually considered to have begun about 1760. He further insists that clocks in the 17th century not only affected industrial organisations, but also affected every aspect of the society: literature, philosophy, theology and therefore, our way of thinking and our view of the world. In his book "*History of the Hour: Clocks and Modern Temporal Orders*" (1996), Dohrn-van Rossum studies the transformation of time-consciousness by the mechanical clock and argues;

> (T)he clock was and is not only the prerequisite and device for a way of handling everyday time that was at first typical of European industrial societies and then of industrial societies in general; it is also the symbol of the process of European modernization, and for describing the experience of mental differences between the old European and the modern world, between European, North American, and Japanese societies and the so-called Third World (p. 3).[16]

4. Time and computers

The reason why the influences of clocks in the 17th and 18th centuries were described above is that we have found a possibility of building an analogy

[16] The last part of the quotation, that is, between the so-called advanced countries and the developing countries, is controversial. To discuss it is beyond the scope of this

between clocks and computers. Bolter (1984) considers the computer as the defining technology of our age. Defining technologies define or redefine our relationship to nature. Clocks and steam engines were defining technologies of Western Europe in the 17-19 centuries. The computer is "the contemporary analog of the clocks" (p. 10) in the previous centuries. From the historical roles which mechanical clocks played in the past, we can reasonably infer that computers have an equivalent potential to affect contemporary society in terms of time. Information technologies can change our time as clocks did in the past. Rifkin (1987) argues;

> It is likely that within the next half century, the computer will help facilitate a revolutionary change in time orientation, just as clocks did several hundred years ago when they began the process of replacing nonautomated timepieces as society's key time-ordering tools (p. 13).

For example, "(M)inutes, and later seconds, did not normally appear on clocks until after the discoveries of Huygens" (Macey, 1980, p. 41), and therefore people did not have time consciousness of minute and second, at least in everyday life. Before the clock, there was no such accuracy and punctuality as we have now. Likewise "the new computer technology is already changing the way we conceptualize time and, in the process, is changing the way we think about ourselves and the world around us" (Rifkin, 1987, p. 13). In the first instance, computers have affected clocks themselves. Computer technology "changed the clock from a mechanical device to a wholly electronic one" (Bolter, 1984, p. 101). Digital watches which are today seen even on young children's wrists can show exact time up to the accuracy of one hundredth of a second, which was impossible until the early twentieth century at least for ordinary purposes. Then how can computers transform our time perspective? Because our life is so firmly embedded in time units determined by the clock such as the hour, the minute and the second that it is very difficult to think of time in a different way. The distinguishing features of the computer provides a clue to the changes in time consciousness (Rifkin, 1987, p. 15). The computer works in a time frame in which the nanosecond, one billionth of a second, is the primary temporal measurement.

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section whose purpose is simply to emphasise huge impacts of the mechanical clock in society or culture since its invention and widespread use.

While we can experience an hour, a minute, a second, even a tenth of a second, it is impossible to experience a nanosecond even if it is possible to conceive of it theoretically. To put it differently, while the clock measures time in relation to human perceptibility, time is organised in the computer at a speed beyond the realm of human consciousness. The computer completes the separation of time from human experience and the rhythms of nature, which started with the mechanical clock (Mumford, 1934; Landes, 1983).

Rifkin also discusses "the accelerated nanosecond culture brought on by the introduction of computer technologies" (1987, p. 6). According to him, the futurists, business leaders and technologists tend to think of time in purely material terms when they compare the computer to the steam engine in the early days of the Industrial Age. For Rifkin, the importance of the computer lies beyond material benefits. Behind them is hidden a more significant level, a new temporal projection. It is in the temporal realm that "the long-term impact of the computer will be most acutely felt by civilization" (p. 14).

Discussions about the impacts of computers on our time in contemporary society have just begun to appear in some literature about cyberspace, digital society and the future society of new technology. In his book "Being Digital", Negroponte (1995) mentions impacts of electronic mail on work time. Electronic mail changes the rhythm of work and play.

> Nine-to-five, five days a week, and two weeks off a year starts to evaporate as the dominant beat to business life. Professional and personal messages start to commingle: Sunday is not so different from Monday (p. 193).

Electronic mail also can make people less sensitive to international time-zone differences (Failla and Bagnara, 1992, p. 672). Using electronic mail, we can communicate reliably with persons who live in different time-zones irrespective of their differences provided that the message is not of an emergency and that the recipients check their e-mail boxes frequently and regularly.

Negroponte gives another example (p. 49) from which we can derive a temporal implication. The nine o'clock news has a special meaning in everyday life almost all over the world, at least for people who have interests in current affairs. They are keen to arrive home by then if possible, especially when a big issue is on like election results. The time of nine at night functions as a reference point for a fairly large number of people in organising their time. Cable TV news networks such as CNN cause this time increasingly to lose its meaning as a temporal reference point because they repeat updated news every fifteen or thirty minutes. The state-of-the-art communication technology can accelerate this trend. Using the technology, one can retrieve and watch news which is updated in a shorter period of time than under current cable TV news networks. More importantly, one can retrieve the updated news when he wants, not when it is delivered by news companies. This kind of technology is said to be technically feasible, but it may take long until it is commercially used. Once it is available at home, nine o'clock is not different from 8:17 and a life style which employs that time as one of its temporal anchors (e.g. nine in the morning for starting work, noon or 1 o'clock for lunch, and 5 in the afternoon for calling it a day) will disappear. In addition, the shorter workweek is already high on the agenda among labour leaders, businessmen and economists in Europe (Rifkin, 1995, pp. 221-235). The need for the shorter workweek is caused partly by information technology which has increased productivity enormously.

In the above, the relationship between information technologies and time in society as a whole was examined briefly. This thesis does not deal with the broad issue. It is beyond the scope of the research. Instead, narrowing down to an organisational level, the thesis addresses how a specific information system affects temporal orders of work in the organisation in which the system exists. However, the research needs to be understood against a background of wider discussions about time, information technology and society because an organisational issue cannot be separated from a social issue. Social change in many cases starts from within organisations. In the distant future, we can have a different time concept and time-reckoning system from the present one. If it happens, it will be generated only by information technologies.

C. The Origins of the Research: Cultural Impacts of Information Systems

To understand the importance of the subject, it is necessary to know in detail where this research originated. Interests in temporality derive from a wider interest: cultural impacts of information systems in organisations. It traces its origins to Hall's 'primary message systems' (Hall, 1959) and Stamper's 'evaluation framing' (Stamper, 1988). In other words, it shares with them an aim to understand how information systems affect culture. Unlike much research in management information systems, this study does not concern immediate economic and managerial impacts, the issues whose results can be relatively easily exploited in practice, although they are important in their own right. It does concern a subtler effect that is more difficult to describe and analyse but in the long run perhaps more important. This thesis investigates the effect of information systems on the way we live, more specifically the way we work in organisations.

1. Culture as communication: Primary message systems

Culture is generally understood as shared thoughts, norms, beliefs, values, way of life, etc. associated with a community. Everything shared or held in common within a community can be regarded as culture. We can communicate with each other because we share culture. Without shared culture, we cannot understand other people's behaviour or even their words and make ourselves understood. However we normally do not notice its importance in everyday life because we are fully immersed into the culture where we live. Everything that we face in everyday life is taken for granted. Only when we are put in an alien country, especially without any preparatory knowledge about its culture, we can feel the power of culture. For example, while most people in the world shake their head when saying no, in the Aegean Greek region people use another gesture for no. They toss their head a bit upward, which means no (Morris, 1994, p. 22). Our face-to-face communication with people in that area would be severely hindered by our ignorance of it. We can communicate with people in other regions successfully and understand them only when we have

some background knowledge about their culture[17]. Hall considers communication as the essence of culture. "Culture is communication and communication is culture" (Hall, 1959, p. 191).

Culture as communication is not constituted as a simple whole. According to Hall, there are ten areas of human activities that combine to produce culture. He calls them 'primary message systems' (PMS). Each of them has a biological basis. Since they are closely connected with each other, we can not only examine each separately, but also examine how they work together to form a culture as whole. Table 1-1 shows the ten areas of cultural messages (Hall, 1959, pp. 38-59; Stamper, 1973, pp. 27-32).

Table 1-1. Hall's primary message systems

Interaction
Association
Subsistence
Bisexuality
Territoriality
Temporality
Learning
Play
Defense
Exploitation

Interaction

Everything that people do involves interaction with something else. Interaction lies at the hub of the universe of culture and everything grows from it. One of the most elaborated forms of interaction is speech.

Association

Societies and their components are organised or structured by various ways of association. Here included are conventions that govern the groupings of people

[17] Hall worked for the US State Department where his task was to train with anthropological knowledge technicians and diplomats who were to be despatched to foreign countries.

and the roles that people play. Rank and hierarchy, class and formal organisation are all phenomena of association.

Subsistence

The processes by which a society satisfies the basic physical needs of daily life and the attitudes which are displayed towards such matters as food, drink and work are referred to as subsistence. It includes everything from individual food habits to the economy of a country.

Bisexuality

Both the ways in which the sexes are distinguished and the relationships which are permitted between them are fundamental to society. The kinds of work that people do are commonly influenced by sex, and these differences help to emphasise sexuality.

Territoriality

There are conventions which govern the division of space between people and its allocation for different purposes. Space intertwines very subtly with the rest of culture in many different ways. For example, territorial rights accorded to a person at the table indicate his position in the hierarchy. Status is indicated by the distance one sits from the head of the table on formal occasions.

Temporality

The temporal conventions in an organisation govern the way that time is constructed and used. These conventions govern when to do things, in what order to do them and how much time is allowed for doing each of them.

Learning

Most behaviour must be learnt. The conventions that govern such things as the time, place and manner of learning or of teaching are themselves a vital part of a culture.

Play

Recreation and humour concern play. This is 'culture' in a popular sense. Painting, music, literature, sports, games, and whatever a society regards as funny are included.

Defence

The individual and the community need defensive techniques not only against potentially hostile forces in nature but against those within human society. Clothing and building materials are for protection against the elements in nature; medicine for protection against disease; military techniques for protection against hostile societies; religious practices for protection against supernatural evil. They all fall into this category.

Exploitation

Knowledge of how to make and use tools and how to exploit materials is an important part of culture. Each primary message system has a material aspect which is closely associated with it. Men and women dress differently; tools go with work; time and space are measured with instruments; there are toys for play, books for learning and even material signs of status.

2. Evaluation framing

When a new technology is introduced to an organisation, it is difficult to analyse its impacts. The impacts of a new technology are not limited to technical and economic aspects but reach out to social and cultural aspects. The technology does not exist separate from other elements of an organisation. Once introduced, the new technology interacts with the rest of organisational components. This tendency is the same or more evident with information technologies. Because information technologies support directly communicative activities within organisations, the essential aspect of culture, they affect, as well as are affected by, cultural and social systems more than any other organisational aspects. Some information systems, however excellent they may be in a technological sense, fail only because the people who are supposed to use them do not like them and do not use them. When developing and implementing a new

computer system, therefore, it is necessary to recognise the effects it is likely to have upon people and demands it will make upon organisations.

For this purpose, Stamper (1988) devised 'evaluation framing'[18]. It is based on primary message systems and provides a systematic method of analysing impacts of an innovation such as a new product, a change to an organisation or a new information system. It suggests that the ten primary message systems be examined in turn when we attempt to predict the impacts of an innovation. It can be extended to a 10 × 10 matrix with the primary message systems on the left and their adjectival counterparts across the top. The matrix represents that a change caused by a new system in one aspect of behaviour has a potential impact on behaviour on every other area of a culture. We can fill in as many as cells each of which represents a shift combined by two areas.

As an example, suppose that a new information system is put into use in an organisation (adapted from Stamper, 1988, p. 119). A new way of communication, e.g. electronic mail, may be employed, and thereby a type of *interaction* must change. The use of the new system may require new skills which are rare among the older (and higher status) members of the organisation. Consequently, a new hierarchy may develop, conflicting with the existing relationship between skills and positions in the organisational hierarchy (or age). This is concerned with *association*. Work practices (*subsistence*) will adjust as the job specifications change, which may bring in a new division of labour between genders (*bisexuality*). The location of computing terminals and new layout of offices will impact the areas of *territoriality*. The scheduling of work is concerned with *temporality*. Usually such a new system requires more formal

[18] Although evaluation framing is based on Hall's taxonomy of cultural patterns of behaviour, it is not just a replication. It is built upon a firmer theoretical foundation (Stamper, 1973; Liebenau and Backhouse, 1990). Stamper put organisational information systems research on the basis of semiotics, a study of signs, which consists of four different levels of analysis: pragmatics, semantics, syntactics and empirics. They represent a range from the most social to the most technical aspects of communication. The first two deal with the content and purpose of communication. The latter two are concerned with the form and means of communication. Evaluation framing was proposed as an analytical tool with which an investigator addresses the pragmatics of information systems, that is, the relationship between culture and information technologies.

training (*learning*). The formality can take away much of the enjoyment (*play*) from the established interactions. The new equipment extends the organisation's capacity for *exploitation* of resources. Finally the new system also raises problems of data security, e.g. access and privacy in information systems (*defence*). In addition to the main impacts described above, secondary impacts can be detected by detailed investigations within each area. For example, the scheduling of work under the new system may produce new regulations or customs about when and how long to interact (*temporality/interaction*). A new shift system also causes new groupings of people by day shift or night shift (*temporality/association*) and may change the time for eating and thereby eating habits (*temporality/subsistence*). This secondary analysis which anchors in temporality continues for the rest of the areas where it can add something. It can be also performed in other areas in turn, which completes a matrix of evaluation framing.

In summary, evaluation framing based on primary message systems shows the likely social and cultural consequences of a new technology. It aims to provide a systematic method to analyse cultural impacts of organisational innovations such as information systems. Among the ten primary messages systems, temporality is considered a core system of all cultures; time is a core system of cultural, social and personal life (Hall, 1983). This temporal research is a part of the project aiming for cultural understanding of information systems and, more importantly, it forms an essential, integral element for profound understanding of culture. In this temporal research, evaluation framing was not addressed further and other areas of culture were not examined. It is hoped, however, that this research is interpreted in a wider context of the cultural implications of information systems and considered as an initial challenge to them.

D. The Purpose of the Research

1. The purpose

As seen in the previous section, this research has its origins in evaluation framing, an attempt to understand cultural impacts of information systems on organisations. However, it does not intend to cover the wide range of the ten primary message systems. It is beyond the scope of a single research project for which limited resources are available. In addition, such an ambitious challenge could end up with just a mix of everything without any penetrating theory. Studies on cultural impacts of information systems should progress step by step. This research suggests that temporality is an appropriate and important point to start.

The research has the following broad purposes:

- First, it examines how information technologies affect temporal aspects in organisations and organisational work.
- Second, it explores social, organisational and managerial implications of the temporal changes caused by information systems.
- Finally, it investigates implications of the temporal changes for the development and implementation of information systems.

In a narrow sense, the purpose of the research could be well understood when it is presented in connection with Barley's study (1988). His work set a foundation for research on the relationship between time and information technologies in organisations. It provides a point of departure for empirical research by devising or modifying some useful conceptual tools such as internal (interpretive) and external (structural) parameters of the temporal world and the symmetry (asymmetry) of temporality. This research can be considered as an extension of Barley's. It will describe and analyse, in as much detail as possible, temporal changes in work induced by a specific information system in an organisational setting. Thereby it is expected to develop issues surrounding time and information technologies, and to modify and enrich some concepts.

2. The structure of the thesis

Apart from this chapter, the thesis consists of six chapters. In Chapter 2, some important contributions across several disciplines to the development of thoughts about time are briefly reviewed. In the main section, emphasis is given to studies on time in management and organisation theory because it is considered to be a neighbouring discipline of information systems research. A classificatory scheme for literature in the area is presented. Chapter 3 is concerned with the foundation of the empirical research. It provides the dimensions of temporal order which will be used as references in describing temporal changes in the fieldwork. Then the research method is discussed. Finally some research issues as regards social and organisational implications which the relationship between time and information technologies carries are presented. They are derived from some studies reviewed in the previous chapter. They are given attention during the fieldwork and investigated in detail in later analysis.

The following three chapters in Part II are concerned with the case studies conducted for the research. Chapter 4 provides background information for the empirical work. It explains first a typical process of international trade, the letter-of-credit cycle. It gives an introduction to Korea Trade Network, an electronic data interchange application. It is followed by descriptions of companies where the case studies were conducted. In Chapter 5, changes in work procedures of the four selected tasks in export administration are described in detail. Each description is followed by an analysis of changing temporal dimensions in each task. Chapter 6 is the main analytical chapter of the thesis. The six dimensions of temporal order are analysed respectively across the four tasks, which gives a comprehensive image of KTNET's impacts on temporality of work. Then follow discussions about social and organisational implications of temporal changes, which form the central arguments of the thesis. Chapter 7 concludes the thesis by summarising it, discussing the contributions it makes, presenting limitations it faces and suggesting further research.

Chapter 2
Literature Review of Studies on Time

A. Introduction

In the previous chapter, we saw that time has not been well explored in information systems or even in the social sciences in general. In comparison with space, which is another fundamental condition of human existence, time is not well treated. While space has been the subject of geography, an independent, time-honoured discipline, such a discipline does not exist for time. We can easily infer a reason from our daily experiences. While we can perceive that space is occupied by an object and thereby can be aware of its existence, it is impossible to feel time by any of our five senses. When we recognise time in a simple form in that the past is gone, the present is passing, and the future is coming, time is generally considered as natural and taken-for-granted. In a word, time seems to be self-evident and thus requires no explanation.

This does not mean that time has been completely ignored among intellectuals in history. Rather, because it seems so simple but elusive, time has fascinated many profound thinkers in natural philosophy. However, time has remained a riddle unsolved throughout history from prehistoric times to the present day (Whitrow, 1980, 1988). St. Augustine said, "What is time? If no one asks me, I know; but if any Person should require me to tell him, I cannot" (1961, p.294). There have been some developments in ideas of time, though. Among them, Newton's and Einstein's accomplishments are too important and essential in understanding the development of ideas of time to be excluded in this kind of literature review. Their works have influenced not only natural sciences, but also social sciences and further the whole view of the world. For example, Einstein's idea of relative time has affected the development of the concept of social time, which is presented in the next section.

Before Issac Newton's great work in the late seventeenth century, time was discussed in traditions of metaphysical and mystical thoughts. Newton was the first

philosopher who thought of time in a mathematical, that is, scientific way. He defined in *Principia* (*The Mathematical Principles of Natural Philosophy*) that "(A)bsolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external" (Newton, 1687, p. 6; Coveney and Highfield, 1990, p.29). For Newton, time is an absolute, unchanging constant, which is simply there, cannot be affected by anything, and just goes on flowing at a uniform rate. This concept of absolute time had dominated the Western world until Einstein overthrew it. According to his theory of relativity, the appearance of the world about us depends on our state of motion. It is also true of time. Now time is different to individual observers depending on how they are moving. Einstein created a new model for the universe in which time and space were linked in a way that there are four dimensions of existence in space-time (three dimensions of space - length, breadth and height - plus one of time) rather than the evolution of a three-dimensional existence over time (Davies, 1995; Morris, 1984; Rogers, 1996).

In addition, physicists, astronomers and biologists deal with time as one of their main subjects (Hawking, 1988; Price, 1996; for studies on biological clocks or biological time, see Appendix in Coveney and Highfield, 1990; Luce, 1977). Time also has been an important subject, quite often explored, on philosophers' research agenda (Bergson, 1950; Heidegger, 1962). This chapter does not cover them because they are beyond the scope of the research. The focus of the research is to investigate the relationship between time and information technologies in organisational settings. Therefore literature about time which has little to do with social and organisational backgrounds is excluded[1]. The criterion adopted is whether they give any organisational insight or not. For the same reason, psychological studies on time e.g. Fraisse (1964), McGrath (1988) and Starkey (1989) are not included unless they have organisational implications.

The task of this chapter is to review critically studies on time in management and organisational studies in particular, which are mainly stimulated by anthropological and sociological works. It is anthropologists who first studied

time as an attempt to understand other cultures (Gell, 1992; Fabian, 1983). For them, time is the core of culture. When they study other cultures, time is often included as an essential element in their ethnography. They concentrate on time-reckoning systems in different societies and on how time is perceived, organised and structured (Adam, 1994). They have investigated time perceptions of other (primitive) societies, and argued, for example, that these societies have different time perceptions from Western ones (Evans-Pritchard, 1940; Whorf, 1956; Hallowell, 1955; Pocock, 1967; Bohannan, 1967). For some classical sociologists time was also a subject of interest (Durkheim, 1965; Sorokin and Merton, 1937; Sorokin, 1943). Since then, there has been a period of interruption during which time has been neglected in social sciences (Adam, 1990, 1995; Bergmann, 1992; Nowotny, 1992, 1994) with an exception of Gurvitch (1963, 1964). Recently, however, time has been brought into the light in social sciences. From some corners of the academic world with social sciences perspectives, time has come to the fore as a separate subject which requires serious and interdisciplinary efforts[2]. In organisation studies, time also has attracted several researchers with new conceptions of time which were influenced by anthropological and sociological traditions. In 1980s and early 1990s, five literature reviews on time appeared in management and organisational studies (Bluedorn and Denhardt, 1988; Clark, 1985; Das, 1993; Hassard, 1989; McGrath and Rotchford, 1983). They intended to renew interest in time in their own areas of study: organisational sociology, social psychology and management. They raised many questions and issues about time in organisations. They also integrated and criticised studies on time in the field with new perspectives. As culture becomes an important and popular concept

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[1] For a comprehensive interdisciplinary bibliography of studies on time, see Das (1990).

[2] In 1992, *Time and Society*, which declares itself as a journal for the social science research on time, was started. In addition, there are three international organisations for the study of time. 'The International Society for the Study of Time', founded in 1966 by J. T. Fraser, is a professional organisation of scientists and humanists who are interested in exploring the nature of time through the interdisciplinary approach. It had published eight volumes of *The Study of Time* series (Fraser, 1966, 1987, 1989, 1992) by 1996. 'The Association for Social Studies of Time (ASSET)' was founded in 1984. Its primary function is to act as a forum promoting interdisciplinary exchange between individuals who have common interest in time as a subject of inquiry. The focus of the Association is on two aspects of the social study of time: temporal patterns of human behaviour, and various conceptions and perceptions of time. It has already organised a series of

in understanding and managing organisations, researchers begin to recognise time as one of the important elements composing culture. Schein (1992) considers time as the most fundamental of culture. Hall (1983) also insists that time is a core system of cultural, social and personal life.

Although the three disciplines, sociology, anthropology and management/ organisation studies, are equally important in understanding the subject of time and information technologies in organisations, most effort will be made in the area of management and organisational studies, which is a neighbouring field of information systems research. Studies from sociology and anthropology will be mentioned only when they are thought to be directly related to the subject. In the next section, a classification of studies on time in management and organisational studies will be presented. It will show how research has been done, and reveal where further research is required. Then, the last section will critically review the general scene of temporal studies, and will finish the chapter by providing some implications for further research on time in information systems research as well as management and organisational studies.

B. Management and Organisational Studies on Time

In contrast to the expectations which this author had before a substantial literature review started, there exists a relatively large number of works which study time. There is also a new interest in time emerging among researchers in organisational studies, which is shown by the recent publication of the five aforementioned papers (Bluedorn and Denhardt, 1988; Clark, 1985; Das, 1993; Hassard, 1989; McGrath and Rotchford, 1983). The critical reading of those review papers and some anthropological and sociological works on time gives us two criteria which could be used in classifying studies on time in management and organisational studies. This section is organised by the two criteria. They are the concept of time and the role of time in research design. In the former, we can

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conferences on time in the social sciences. 'The Project on Time and Organisation' is a research group focusing on organisational time.

discern two contrasting views on time: the clock-time concept and the social time concept. In the latter, we can see two fundamental roles which time plays in research design, that is, independent variables and dependent variables. Then, intersecting the two criteria, we see four categories to which each study on time belongs. These four categories form the main part of this section in which we will examine major studies on time in the field. Before that, the two criteria are explained in detail.

1. The concepts of time

a. The clock-time concept

When asked a question "what is time?", people generally think of clocks or watches on their wrists and calendars on the wall. It is the clock-time concept that most people have in mind, consciously or unconsciously, when they think of time. It is characterised as homogeneous and divisible in structure, linear and uniform in its flow, objective and absolute, that is, existing independent of objects and events, measurable (or quantifiable), and as singular, with one and only one 'correct' time (Bluedorn and Denhardt, 1988, p. 302; Clark, 1985, p. 46; Hassard, 1989, p. 17; McGrath and Kelly, 1986, p. 29). This concept is the dominant one in our contemporary society[3], and the basic assumption upon which our society relies for its operation and management. It is often called 'the linear-quantitative tradition' (Hassard, 1989), 'even time' (Clark, 1985), or 'the Newtonian conception' (McGrath and Kelly, 1986).

The quantifiability of clock time gave birth to another important concept of time in history. As labour was paid by time, and entrepreneurs became sensitive to the productivity of their enterprises calculated by the formula in which time is a denominator, time began to be recognised as a resource. This concept of time as a resource is as common as the clock-time concept. It reminds us of the aphorism that 'time is money'. According to this metaphor, time can, like money, be spent, saved, wasted, possessed, budgeted, used up and invested. People understand time

[3] For the historical nature of the clock-time concept, and, especially, its relationship to the development of modern industrial society, see Clark (1985), pp. 45-51 and Bluedorn and Denhardt (1988), pp. 302-303.

in financial terms in most cases of everyday life, especially in business and management contexts. In management, time has been closely related to productivity. An organisation is considered more productive or efficient when it shortens the period of time it takes to accomplish a given amount of work. Time is viewed as a resource which should be "measured and manipulated in the interest of organisational efficiency and effectiveness" (Bluedorn and Denhardt, 1988, p. 303). This concept of time has dominated most research in management and organisation studies. As mentioned in the previous chapter, one of the purposes of this research is to overcome this simplistic view of time on which most studies on time build in this field. Such a view might be useful for a practical purpose, but is limited for a comprehensive understanding of time and information technologies in organisational settings.

b. The social time concept

This concept has several variations. Das, who made a comprehensive bibliographic survey (1990) in about 20 disciplines ranging from biology to sociology, attributes the reason for the neglect of time, and therefore, for the lack of research on time to "the unexamined conception of time in terms of the clock and the calendar" (1993, p. 269). Most studies about time do not deal with time as a problematic or researchable phenomenon. They presume that all organisational actors behave with the belief that time flows linearly like a straight arrow with a constant pace. In other words, most researchers take time for granted and do not recognise the problematic nature of time itself. Das insists that time needs to be problematised in management and organisational studies to produce fruitful research on time. As an alternative, he suggests subjective time. Time should be recognised as a subjective phenomenon. Subjective time implies a time conception which is shared (or owned) by any subject or entity, whether it is an individual, group, organisation or any other entity that is of interest to management and organisational research.

Other writers of review papers on time (Bluedorn and Denhardt, 1988; Clark, 1985; McGrath and Rotchford, 1983) share Das' view although they are from different disciplines: organisational studies, organisational sociology and

social psychology. They all argue that the clock-time concept is a very limited conception, and too simple to understand organisational phenomena with it. The clock-time concept should be complemented by concepts which have rich implications for deeper understanding of organisations in the context of culture (Schein, 1992). Bluedorn and Denhardt emphasise the plurality of time. Although our life is so embedded in time that people simply regard it as unchangeable and taken-for-granted, "time is fundamentally a social construction that varies tremendously between and within societies" (1988, p. 300). For example, the clock-time concept is just one historical concept which was evolved with the development of the capitalist society, and on which the contemporary industrialised Western societies are based. Clark (1985, p. 36) argues a similar point. It is impossible to undertake a sociological analysis of the "time dimension" by relying solely on the metaphor of the clock. Sociological analysis requires a theory of time which recognises that time is socially constructed. He insists that despite the dominance of the clock-time concept, there still exist some areas which are governed by 'event time', which will be described later in this section. Whatever they may be called, social time (Lauer, 1981), organisational times (Gherardi and Strati, 1988), subjective time, the plurality of time, event time and so on, their underlying assumptions are all the same; time is socially constructed, and the clock-time concept should be complemented by these other concepts of time.

2. The roles of time in research design

The second criterion by which studies on time in the field are classified is the functional roles of time in research design. Regardless of which concept, clock-time or social, is employed in each study on time, we can discern either of the two separate roles which time plays in its research design: the role of the independent variable and the role of the dependent variable[4].

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[4] McGrath and Kelly (1986; Kelly and McGrath, 1988), from whom the term 'functional roles' is borrowed, suggest another set of methodological issues. "Temporal factors can be a source of methodological problems for social-psychological studies of any content area. ... we can study how various temporal factors may influence our research strategy, designs, measures, and manipulations in studies of any social-psychological content" (1986, pp. 8-9).

When this thesis was in its final stage of production, a paper (Sawyer and Southwick, 1997) which addresses these methodological issues of time was published in the proceedings of the IFIP International Conference on Information Systems and

a. The role of independent variables

When time takes this role, the focus is given to the impacts of temporal factors on various organisational processes. We study here how various temporal factors of individuals, situations and environments affect various aspects of individual, group or organisational behaviour. For instance, how does time pressure affect individual problem-solving performance? We can also examine the consequences of different time concepts among individuals, groups, organisations and societies for management practices and management strategy formulation.

b. The role of dependent variables

When we raise research questions of how various organisational factors affect the time dimension, time plays the part of a dependent variable. We investigate how various individual, situational and environmental factors in organisations affect the way individuals conceptualise, experience and use time, and how those factors may alter the temporal patterning of behaviour. For example, we can study how attributes of the problem for which a decision should be made affect the amount of time which is required for the decision. Technological change such as the use of information technologies can also be considered as an organisational factor which affects temporal behaviour in organisations. Here time is considered as an object to be changed, not as being constant.

3. Four categories of organisational studies on time

So far the two criteria for the classification of studies on time in organisation studies have been presented. They are the concepts of time, and the roles of time in research design. Of the two conceptions of time found in the field, clock-time and social time, the latter is not integrated yet and includes several variations. Whatever aspects of time other than clock-time may be emphasised, and whatever they are called, they share the common idea of social construction, that is, time is socially constructed. Therefore it seems to be proper to pose the

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Qualitative Research (Lee et al., 1997). The paper should be appreciated in that it not only deals with the methodological issues, but also raises organisational issues regarding temporality.

social time concept as the antithesis of the clock-time concept. Regardless of its concepts, time plays the two different functions in research: independent and dependent variables.

Intersecting the two criteria, we get four categories of temporal studies. In category I, time is conceived as clock-time and plays the role of independent variable. Here the effects of clock-time on various organisational phenomena are examined. In category II in which time is conceived as clock-time and treated as a dependent variable, changes in the time dimension which are caused by various organisational factors are traced. In categories I and II, time is presumed to be linearly flowing, evenly paced, divisible, and measurable. No questions on the nature of time are raised. Most studies such as time and motion studies, time allocation, time management, time series analysis, time budget and so on belong to these two categories.

In category III where various concepts of time are suggested and time is treated as an independent variable, the effects of time as being socially constructed on, and its relationship to, organisational processes are studied. Here time is assumed to exist in its variations according to cultures, organisations or societies. In category IV where time is conceived as a social construct and dealt with as a dependent variable, changes in the time dimension induced by various organisational factors are investigated. In categories III and IV, the concept of time is problematised. Time is treated as an intrinsically complex and problematic phenomenon. Attempts to overcome the restricted view of the clock-time concept are made in these groups. The idea of the social construction of time is generally accepted here. Because time is socially constructed, it may vary according to groups, organisations and societies. Based upon this assumption, studies in categories III and IV try to understand complex organisational phenomena related to temporal issues. They argue that temporal issues in organisations cannot be properly tackled with the fixed and limited concept of clock-time. Establishing the scheme of the four categories, I put research into each category. Table 2-1 shows

typical issues which are covered in each category, and Table 2-2 shows representative authors in each category[5].

[5] This classification scheme has some limitations. It is not clear-cut because certain studies can belong to more than two categories. To take Lawrence & Lorsch (1967) as an example, we can put it in category III if we interpret time orientation as subjective time as Das suggested. But I put it in category I because the aim of the research is to investigate how time orientations (an independent variable) measured by the time span of feedback (clock-time) affects integration in organisations. And the fundamental assumption on time which the authors kept in mind did not go beyond the clock-time concept. In addition, the classification can be criticized that the terms 'independent' and 'dependent' are irrelevant. The terms imply the high rigidity of research, as in experiments, but in fact, some studies in the table do not satisfy such a rigidity. In other words, there are studies where it is difficult to say that time plays the role of an independent or dependent variable in a rigid sense of the terms. Therefore, for some studies, the terms such as 'preceding variable', 'background phenomenon' or 'constant' are more suitable than 'independent variable'. Although this classification requires further effort for elaborateness and rigidity, it has a significance as an attempt to classify temporal works in management and organisation studies, which had never been attempted.

Table 2-1. Four categories of organisational studies on time

	The concept of clock-time	The concept of social time
Independent variable	**Category I** - time orientation - time as resource - time pressure and deadline effects	**Category III** - multiplicity of time - strategy building
Dependent variable	**Category II** - time use or time budget - working hours - decision making and time horizon	**Category IV** - evaluation framing - technology, time and social order - information technology and time frame

Table 2-2. Four categories of organisational studies on time by authors

	The concept of clock-time	The concept of social time
Independent variable	**Category I** - Lawrence & Lorsch (1967), Lorsch & Morse (1974), Hill (1956), Jaques (1956, 1964, 1967, 1979) - Moore (1963), Hassard (1991) - Gersick (1988)	**Category III** - Kluckhohn (1953), Usunier (1991); Clark (1985), Roy (1960), Gherardi & Strati (1988); Dubinskas (1988), Schriber (1986), Schriber & Gutek (1987) - Das (1986, 1987, 1991), Hay & Usunier (1993), Ramaprasad & Stone (1992)
Dependent variable	**Category II** - Gershuny (1986), Hewitt (1993) - Pollay (1970) - Goodman (1973)	**Category IV** - Stamper (1988) - Barley (1988) - Failla & Bagnara (1992) - Kavanagh & Araujo (1995)

a. Category I

In category I, there are three main topics: time orientation, time as a resource, and time pressure and deadline.

< Time orientation >

Lawrence and Lorsch (1967) and Lorsch and Morse (1974) are among the most frequently quoted works in literature reviews on temporal research in organisation studies. They are rarely omitted in literature reviews, not because they made a substantial contribution to the temporal research field, but because their works are among the earliest attempts to investigate temporal aspects of organisations, even though their works do not seem to have started from temporal insights. Lawrence & Lorsch (1967, pp. 34-36) suggested that the time orientation of members of each department in an organisation plays a significant part in the departmental differentiation and integration in the organisation. The time orientation was directly connected to the time-span of definite feedback that each department received from its environment. The time-span of feedback is measured in terms of clock-time. For example, the members of both production and sales departments for whom rapid feedback is available from the market tend to have shorter time orientations. In contrast, scientists in a fundamental R & D department who receive the final feedback of success or failure in their activities only when a project has ended, which usually requires a year or longer, have much longer time orientations. The differences in their time orientations may cause problems for the organisational integration unless it is properly recognised and managed. Time orientation is often expressed as time horizon (Ebert and Piehl, 1973).

Hill (1956) and Jaques (1956, 1964, 1967, 1979) addressed the notion of time-span of discretion. Jaques related the time-span of discretion in a role to the weight of responsibility experienced by the incumbent of the role, and to the incumbent's judgement of what constitutes fair pay for the work given to him. Here the time-span of discretion is the maximum period of time during which a manager relies on the discretion of his subordinates and they work on their own account. It can be objectively measured by the maximum spans of assigned goals. They are ascertained by talking with the manager and assisting him to explicate his

decisions with respect to targeted completion times for his subordinate's assignments. Jaques showed how the felt weight of responsibility on the part of an organisational member is related to the maximum period of time (independent variable) for which discretion is required to be exercised in carrying out the assigned duties.

< Time as a resource >

As described previously in this section, time is considered as a resource. This notion of time is well expressed in the aphorism that time is money. It is a variation of clock-time and the most dominant and widespread one in modern organisations. Time is a resource which should be managed to increase organisational efficiency. A good example of writers who make clear the notion in organisation studies is Moore (1963, p. 169). He viewed time as an organisational resource that is finite and scarce, and which can be measured by person-time units or man-hours in conventional business computations. Time as a resource presents the problem of allocation.

Hassard (1991) assesses the difficulties which organisations face in controlling temporal assets. He describes three tactics which organisations use to cope with time scarcity, that is, to allocate limited time resources to a range of productive activities. First, organisations adjust the specific time locations of activities. Organisations need ways of freeing activities from their fixed locations in 'real' time. For example, employees are often pressed to do two or more things simultaneously. It is the most pressing time problem for employees. The only solution to this problem is through time relocation: through having one or more of these events extracted from its location and re-scheduled. Second, organisations redistribute peak-time loads over other phases of a time cycle in order to make better use of system capacity as a whole. In other words, to operate more effectively, they either increase capacity during periods of low load or decrease capability during periods of high load. Third, organisations try to recover time that would otherwise be lost. McGrath and Rotchford (1983), though they acknowledge cultural influences on the concept of time or the social construction of time, also describe time as an objective resource.

< Time pressure and deadline effects >

Time pressure is a frequently researched topic in decision making research. A typical question is "how does the amount of time available to make a decision affect the quality of the decision and the process used to make it?" (Bluedorn and Denhardt, 1988, p. 309). For example, the greater time pressure is, the more vigorous search for alternatives becomes, and selective perception is the most acute where time pressure is the highest (March and Simon, 1958, pp. 116, 154). Deadline effects is another expression of time pressure. Group development is studied in terms of deadline (Gersick, 1988, 1989). Project groups that are given a specific deadline for the completion of their projects do not accomplish their work by following the sequence predicted by traditional models of group development. Instead, they progress in a pattern which Gersick describes as "punctuated equilibrium," through alternating inertia and revolution in the behaviours and themes through which they approach their work. Groups' progress is triggered by members' awareness of time and deadlines. Her work is significant in that it extends research on the impact of deadlines to the group level of analysis.

b. Category II

Studies on time use or time budget are classified into this category. As new technologies get introduced in every area of society, people's time use at home, work and leisure has been changed (Gershuny, 1986; Pronovost, 1989, Chapter 5). Debates about the reduction of working hours, flexible working time and shorter work week in industrial relations and labour economics belong to this category (Hewitt, 1993). Some studies on time and decision making are also included when the issue is raised in the form of a question of how the attributes of a problem itself influence the length of time needed to make the decision. Intuition says that given a fixed number of alternatives, the presence of inferior, easily rejected alternatives ought to make the problem of reaching a decision easier and less time consuming than when all of the alternatives are equally attractive. Contrary to intuition, however, decision makers take longer to make a choice from four alternatives when two of the alternatives are easily rejected than when all four alternatives are of equal quality (Pollay, 1970). Pollay found that personality factors are related to the time it took to make a decision in these two alternatives. Issues surrounding

time horizon also can be dealt with in this category. Goodman (1973) studied the effect of rich knowledge about the environment on an organisation's time horizon and concluded that an increase in the richness of environmental knowledge shortens 'actual' time horizon, and vice versa.

c. Category III

Two groups of studies are included in this category. First, various notions of time - contrasted with the clock time concept - are suggested. Different cultures, societies, organisations and professional groups may have different notions of time. The first part below deals with this multiplicity of time at cultural, organisational and professional levels. Studies in the second group are based upon the results of the first because they are concerned with effects which those temporal differences at various levels make on organisational and individual behaviours. For example, researchers of business strategy consider differences in time as one of factors which influence strategy formulation.

< The multiplicity of time >

The idea that our conceptions of time depend on the culture or society in which we live is far from new. Kluckhohn (1953) suggested that different cultures have different dominant preferences of past, present or future orientation. According to this view, as already argued in Chapter 1, the dominant conception of time in our contemporary society - time as linear, homogeneous, divisible, abstract, measurable, singular and objective - is neither inevitable, nor culturally universal, nor historically constant throughout our culture's past (McGrath and Rotchford, 1983, p. 70). They argue that it is just the dominant conception which is current in contemporary culture, dominated by Western culture, and in formal organisations within it. This conception thereby determines what "problems" will arise, how they will be formulated, how they will be coped with, and what will be regarded as solutions to them. Usunier (1991, p. 201) empirically examined the existence of differences in time-perceptions across national groups with a view to facilitating marketing negotiations in international business.

At an organisational level, Clark (1985) distinguishes 'even time' from 'event time'. Even time, another name of clock-time, has four main features;

> it flows evenly and continuously; is free from contingent events and periodicities; and is completely quantifiable and so can be added, subtracted, divided, used in a variety of heuristic calculations and in complex formulae (pp. 46-47).

The features of event time consist of quite the opposite. Event times[6] flow unevenly, are discontinuous, contain varying levels of contingency and indeterminacy with respect to the onset of event trajectories and even to their actual occurrence. Their units are relatively imprecise and cannot be calculated. Event times are highly local and some are known to only a few organisational members. According to Clark, time does not exist outside of events, but time is *in* the events and events are defined by organisational members. Time is therefore relative[7], not absolute, and there are a plurality of times each of which is appropriate to understanding specific phenomena. Event-based temporalities play an important role in organisational life. The central "time problem" for organisational sociology is to overcome the clock-time concept. In other words, the challenge facing organisational sociology is to incorporate a notion of the plurality of time-reckoning systems which are embedded in the social constructs of organisation members (p. 36). Two case studies from the sugar beet industry and the can making industry in Britain show that organisations may experience temporal differentiation within the short period of, say, a year, and that these changes make differences to organisational structures. He emphasises that modern organisations rely on event-based time reckoning as well as on clock-based systems. Much more research is required to explicate the 'hidden' structures of rules which are devised, and being devised, to organise the times of employees in organisations.

The conception of event-based times is well illustrated in some empirical studies (Cavendish, 1982, pp. 111-118; Roy, 1960). Roy outlines how workers

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[6] We can use the plural form of the word 'time' here because the event time is not absolute, and each organisation may have its own time by this definition.

engaged in work which involves the repetition of very simple operations over an extra-long workday, six days a week overcame a formidable "beast of monotony." They made their experiences tolerable by putting meaning into their essentially meaningless days. They established their own event-based, time-reckoning system for structuring the day. They punctuated their monotonous and boring working day with several interruptions designated as 'times', each of which was the signal for a particular form of social interaction. The regularity of 'peach time', 'banana time', 'window time', 'pickup time', 'fish time' and 'coke time', together with the specific themes which accompanied each time, meant that instead of the day being endless it was transformed into a series of regular social interactions. In place of a single, long time horizon, they had several short horizons.

Gherardi and Strati (1988) argue for the existence of 'organisational time' parallel with objective, external time. They showed how a particular organisation possesses one generally shared organisational time (the relativity of time), and highlighted how there existed multifaceted times within the one organisational time (the plurality of time). They consider organisation time as an important variable in decision-making processes; the introduction of the time element into the theory of the decision-making process powerfully increases its interpretive capacity.

Dubinskas (1988) examined professional differences in temporality. He distinguishes two contrasting domains of temporal patterning in biotechnology companies where biologists work with managers from an economics or business background. The two temporal domains are planning time and developmental time. Contrasting styles of presenting and arguing over plans distinguish managers with planning time from scientists with developmental time. Planning time seeks closure; developmental time is open ended and can extend far into the future. The managers viewed time in a linear way, with targets and milestones tied to external objective realities like market opportunities and the stock market. In contrast, the biologists seemed to operate on a temporal patterning best characterised as "things

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[7] The word 'relative' and the preceding sentence 'time is *in* the events' remind us of Einstein's influence on thoughts about time in social sciences. Einstein's theory of relativity shattered Newton's claim that time is separate from events.

will take as long as they will take," referring to natural biological processes that have their own internal time cycles. Managers and scientists operating in terms of these two separate types of time respectively must first understand the differences in each other's assumptions to avoid unnecessary conflicts and work together properly. Schriber (1985) considers time as an underlying aspect of organisation culture. "How time is partitioned, scheduled, and used has both dramatic and subtle influences on organisations and the people in them" (Schriber and Gutek, 1987, p. 642). She found that among work groups within the same organisation, among professional groups, and among organisations there were differences in the time dimensions[8] of organisation culture, e.g. norms of time in organisations.

< Time and strategy >

Differences in temporality among cultures, organisations and professions may affect a wide rage of organisational processes and individual behaviour. Decision making and learning processes (Butler, 1995), negotiation, innovation and so on are influenced by notions of time which the actors or parties concerned have in their mind. Among them, strategy formulation is one of the frequently mentioned topics as time is the fundamental dimension in which strategic planning takes place.

Das (1986, 1987, 1991) relates the future orientation of organisational members to various aspects of strategic planning in a contemporary corporate environment. He classifies planning actors according to their individual perspectives of the future, and investigates the relationship of the perspectives to their preferences for short and long planning horizons. In this work, he developed an instrument to measure the individual future orientations. An individual with a relatively 'near' future time perspective tends to anticipate that the most important events would occur relatively sooner than an individual with a 'distant' future time perspective. The determination of planning horizon, defined as the period of time for which the plan is developed, is a critical factor in the strategic planning process, as it forms the basis for the allocation of corporate resources and energies, as well

[8] Schriber's time dimensions are very important in this research. They will be explained in detail in Chapter 3.

as the co-ordination of short-run and long-range planning. He shows that planning actors with near future time perspective will prefer a shorter planning horizon than those with distant future time perspective, and the latter prefer a longer planning horizon. Hay and Usunier (1993) examined how different concepts of time across cultures influence and shape the practice of strategic management and its success in international banking in four countries: US, UK, Germany and Japan. A central proposition is that Japanese corporations and banks operate with a culturally specific concept of time which shapes their strategic planning process. They conclude that to understand an organisation fully, and to make sense of its strategic choices, the mission it pursues and the plans it adopts, it is necessary to elucidate its temporal culture. Ramaprasad and Stone (1992) propose a concept of strategic time based on events rather than the clock.

d. Category IV

If time varies depending on work groups, organisations and societies, as suggested in category III, there is no reason that we cannot assume that time itself is affected by various organisational factors. There is little research which investigates the effects of changes in organisational factors such as innovation and technology (which is a focal point of this research) on temporal aspects of organisations or organisational work. Only four studies have been found suitable for category IV: Stamper (1988), Barley (1988), Failla and Bagnara (1992), and Kavanagh and Araujo (1995). Stamper, as explained in Chapter 1, does not exclusively focus on time, which is one of ten streams of cultural message, and his evaluation framing ended up with just a suggestion for further research. However it deserves to be mentioned here again in that it challenges the question of how technology affects cultural systems, in which temporality takes a central position.

In a study of the introduction of computerised equipment into radiology departments, Barley (1988) examines the impacts of the new equipment on temporality and on social relations. It is the only empirical research in organisational studies that analyses how technologies alter the temporal order of a workplace. It is already presented in detail in Chapter 1 because of its overall importance for this research.

Failla and Bagnara (1992) address the problem of changes in time caused by information technology. They focus specifically on the relationship between time in decision making and information technology, but it has many implications for the study of time in information systems research. The following three are important among them. Although they give us a wide range of rich ideas for the issue of time and information technologies, Failla and Bagnara, like Stamper, do not seem to have conducted any empirical work on these issues yet.

< Changes in time-frame >

The introduction of information technology causes profound changes in the time-frame patterns of the decision-making process. These changes are not limited to decision-making process. Information technology eliminates rigidity in work rhythms, giving flexibility. The organisation of work is increasingly becoming less rigid in terms of time-patterns. This is especially true in the case of professional work performed in offices with information technology support. The application of information technologies to knowledge-based activities

> generates work methods that cut across the 'traditional' sequence of events, changing the durations customarily regarded as 'appropriate' and reducing the need to 'program' activities, and hence to resort to rigid timetables. The effect of these changes is to disrupt the traditional work rhythms. In this sense, information technologies help to eliminate or diminish the importance of time-frames generally accepted as appropriate for performing a given activity (Failla and Bagnara, 1992, p. 678).

< Differential changes in the time-frames >

The impacts of information technology on time assume different patterns depending on the stages in the development of information technology. Failla and Bagnara classify its development into three stages: the automation of routine activities, decision support technologies and virtual reality technologies. Each stage has a different meaning in terms of time.

In the automation of routine activities which is typical of the early stages of information technology, there still remains the same high degree of rigidity in work rhythms. Such high rigidity characterised the mechanical technologies of the

first industrial revolution. In this phase users complain that information technology dictates the rhythm of work. They are required to adapt to machine time. Some attitudes of resistance to information technology can be attributed to the disorientating effect of the 'new' rigid time-frames imposed by the technology.

The next stage is characterised by the proliferation of direct users of information technologies generated by the development of microelectronics and the advent of the personal computer. This phase sees the development of information technologies for individual decision-making such as spreadsheets, databases and packages for statistical analysis. Although these technologies for decision support systems make changes in decision-making processes, the most significant transformation is their disrupting effect on rigid time-frames. Due to the decentralisation of processing capacity through the personal computer and the subsequent development of specific applications to support individual decision-making, a new relationship with technology has been generated. The relationship is no longer subject to the time constraints of centralised systems. When the technology evolves from supporting individual decision-making and decisions on specific problems to aiding organisational decision-making such as group decision support systems or computer supported co-operative work, bigger impacts on time are expected.

Presently information technology is experiencing another phase of development which is likely to have a qualitative impact on time. The new technologies make it possible to project virtual reality and help us to simulate the consequences in advance. Failla and Bagnara call this kind of information technology 'virtual reality technologies'. The decision-making process has always been based on past experiences. With information technology, however, we can possibly gain experience of scenarios or events that have never been encountered in real life. Virtual reality technologies therefore allow "future" or unexperienced experiences to be experienced. We can reconstruct the experience needed to generate alternatives with the help of information technology. It allows simulation of the future and thereby, modifies the time-frames which are no longer relegated to repetitions of the past with little variation.

< Cultural consideration >

Yet another of the implications of Failla and Bagnara's study, which is more important in organisational studies, is their emphasis on organisational culture. They argue that the relationship between information technology and time should be considered in the context of organisational culture. It has been well described how information technology affects individual time patterns. The interaction with information technology also has important effects on time patterns at an organisational level. IT's impacts on time encourage the members of the organisation to reorganise their time. But it is essential that any such reorganising of time be shared by, and be consistent with the specific organisation's culture in order that the organisation functions properly. The members of an organisation need to understand the changes in standard time-frames generated by the latest information technologies to achieve the level of reciprocal reliability that is indispensable for co-operation.

Recently, Kavanagh and Araujo (1995) presented a multi-layered view of time in which different temporal frames coexist and draw upon each other for their existence and sustenance, and illustrated the processes through which time is constructed. They demonstrated through the use of actor-network theory and a metaphor of the Japanese art of paper-folding how these different forms of temporality are the product of heterogeneous networks combining associations of human and non-human elements.

4. Concluding remarks on organisational studies on time

We have so far reviewed studies on temporal issues in management and organisational studies. The review shows that there is a difference in the quantity of research among the four categories. It is partly due to two notions of time: the clock-time concept, and as one of the consequences of this view, the notion that time is constant and unchangeable. The two notions have been dominant and widespread in the community of organisation studies as well as in everyday life. Although some researchers begin to recognise the problematic nature of time, that it has a characteristic of social construction, and that as such it may vary according to individuals, groups, organisations and societies, they are not completely

liberated from the clock-time concept. The notion of constant and unchangeable time is still overwhelming among researchers in organisation and management studies who are interested in time. This is reflected in the fact that there is much more research in category III than in category IV. It is reasonable to say that researchers in organisational studies are increasingly aware of the multiplicity of time, but still tend to think of time as a constant or background phenomenon.

In conclusion, most studies on time in management and organisational theory are based on mundane conceptions of time such as clock time and the notion of 'time is money', as described above. At a glance, there is much research on time in the field: time and motion studies, time allocation, time budget, time management, forecasting, time series analysis, to name a few. However it would be more appropriate to call them *'time-related research'* rather than *'research on time'* because they do not deal with time itself as their main subject. In other words, they do not question the nature of time. Time is treated as given and taken-for-granted, and therefore it is thought of as if it did not deserve serious research. I conclude this section by saying that whilst there is much *'time-related research'*, there is little *'research on time'*. Research on time in management and organisational studies is not as satisfactory both in quantity and in quality as it should be for its importance in understanding complex organisational phenomena. Time has not been treated as an object of serious inquiry in management and organisational studies.

C. Conclusion

This chapter finishes by providing three suggestions drawn from the literature review for further research on time.

First, more effort should be given to research on time which addresses the notion that time is socially constructed and as such changeable, not constant. The cell of category IV has only a few studies in comparison with the other cells. As described in Chapter 1, information technologies have great potential to change

temporal aspects of our lives. The clock-time concept is so short-sighted that it cannot cover complex organisational phenomena and understand changes caused by new technologies. Das makes the same point by saying that the clock-time concept does not involve the human actor centrally (Das, 1993, p. 268). It isolates the human actor from time as the mechanical clock itself had dissociated time from nature since its invention and widespread use. Therefore the clock-time concept should be, at least, complemented by other temporal concepts which recognise time as a social and changeable object.

Second, there is a lack of empirical research which can support various concepts of time. Especially in category IV, some papers have been written and are very imaginative, but empirical works which add substantial content to them are rare. Except for Barley's (1988), the rest are still at a conceptual level. Failla and Bagnara's, and Stamper's works need to be supplemented by empirical investigation. For example, some ideas in Failla and Bagnara's should be put under a strict empirical test. This thesis is an attempt to fill this empirical gap in research on time.

Finally, as suggested by Schein (1992) and Failla and Bagnara (1992), research on time should be laid in the context of organisational culture. For anthropologists, time is at the centre of culture. This is also true of organisational studies. The social time concept already presupposes culture. When time is considered along with other cultural aspects in organisational contexts, the study of time could be more productive for understanding organisations, and furthermore the information systems within them.

These suggestions apply not only to management and organisation studies. Time has not been properly recognised in information systems research, where the clock-time concept is dominant. Even a little knowledge about how information systems function in the temporal order of organisations will contribute to the design and development of sound and effective information systems.

Chapter 3

The Dimensions of Time and the Research Method

A. The Dimensions of Time

1. Introduction

To investigate how information technologies affect temporality in organisational work, we first need to know what constitutes temporality. In other words, for an analytical purpose, it is necessary to devise a set of variables which help to understand various aspects of temporality. I suggest that we call them 'the dimensions of temporal order'. However, the lack of research on time in management and organisational studies which was pointed out in the previous chapter means that there are few conceptual tools which have been developed to deal with time-related phenomena in organisations. There are only a few researchers who showed an interest in investigating temporal aspects of social organisation in the work place and, for that purpose, worked out some useful concepts (Schriber, 1986; Schriber and Gutek, 1987; Zerubavel, 1981).

In this chapter, I will present those concepts in detail. I will also outline how I have developed a set of dimensions for this research by drawing on their work. Based upon both the previous research described in chapter 2 and the dimensions of temporal order presented in this chapter, I will raise some research issues which the fieldwork addressed. They are presented in the final section. The questions in the interviews, a substantial part of the empirical work for the research, are derived from both the dimensions of temporal order which describe the external aspects of the changing temporality in work on the one hand, and the research issues which investigate the implications, managerial and social, of those external aspects on the other.

2. Various aspects of temporal order

a. Zerubavel's dimensions

Zerubavel, a sociologist who is interested in time as one of the fundamental parameters of any social order, delineates four major dimensions of the temporal

profile of any situation or event: the sequential structure, the duration, the temporal location and the rate of recurrence (1981, pp. 1-9).

The sequential structure, one fundamental parameter of situations and events, tells us in what order they take place. It is in the nature of many events, activities and situations that they cannot all take place simultaneously and must, therefore, be temporally segregated from one another in terms of 'before' and 'after'. The sequential order in accordance with which events are arranged may sometimes be purely random. However, it is very often the case that it is rigid in the sense that events are not reversible.

The duration, a second major parameter, concerns how long situations and events last. Numerous events in social life have relatively fixed duration on a regular basis. Most of the timetables and schedules we use would not be possible if it were not for the relatively rigid duration of events and activities in our daily life.

The temporal location tells us when situations and events take place. Locating an event at a particular point over the continuum of time is the basis of scheduling, by which we routinely fix events and activities at particular prearranged, and often standard, points in time - at particular hours, on particular days of the week and in particular months of the year. In general, most of our routine daily activities are scheduled in a fairly rigid manner for particular times of the day and for particular days of the week. Fixing the temporal location of events entails the norm of 'punctuality', which assigns a normative character to the acts of being 'early' or 'late'.

The rate of recurrence is concerned with how often situations and events take place. When they occur repeatedly and regularly, they entail rhythms or cycles. For example, that a particular meeting is held every Friday implies that it has a weekly cycle.

The four dimensions above are separated for an analytical purpose. In reality, they are closely connected to each other. For example, we cannot decide

the temporal locations of a series of events, in other words, we cannot make a schedule for them, if we don't know their durations, sequences and patterns of recurrence.

< Conventionality >

Across the four dimensions, Zerubavel emphasises their conventionality (1981, pp. 2-11). As mentioned in Chapter 1, unlike the physiotemporal and biotemporal orders, the sociotemporal order is not natural and inevitable. It is socially constructed, and therefore subject to conventionality and carries normative characters.

As for the sequential structure, some irreversibilities are determined by nature or are inevitable from a logical or technical standpoint. In a research process, for example, data collection precedes data analysis which then follows writing a report. However, it is a mere artificial convention that underlies most of our social customs such as serving soup before, rather than after, serving meat. Similarly the sequences of many bureaucratic procedures is by no means natural and inevitable, although they may have good organisational rationales. Under various circumstances, the sequential structure of these procedures may be altered. In general, many socially based irreversibilities are conventional and symbolic in nature.

It is also true of duration. The durational rigidity is often technologically or biologically determined. However, it is also conventional as seen in, for example, working hours (8 hours), tea time (about 20 minutes), classes in school (50 minutes) and so on. Although there might be justifications for the 8-hour working day that it meets with our biological requirements or is within our psychological limitations of concentration, it is evident from history that the 8-hour working day is the social and historical product of an ongoing struggle between the labour and management.

Likewise the basis for locating certain activities and events at particular time periods is, very often, purely conventional. Compare the reasons for sowing

in the spring or hunting in the daytime with the reasons for going to church on Sunday or starting work in the morning.

Many of the rhythms that govern social life are also entirely conventional. To show the conventionality of rhythms, it is enough to take as an example the time unit of the seven day week as already presented in Chapter 1. The week now has a 7-day cycle, but at other times and places it[1] has ranged from 3 to 10 days. The week has neither common uniform mathematical properties (like the number ten), nor clear astronomical connections. Nor does it have direct biological connections. Rather, it has *social and economic* import (McGrath and Kelly, 1986, p. 37). The concept is derived from a term originally related to the periodicity of "markets" - opportunities to trade for food and other goods. Therefore, its duration was related to both food preservation and transportation technologies. In Judeo-Christian cultures, the week acquired religious significance as the Bible says that God created the world in seven days. In recent times, it has acquired a new form of economic significance, as seen in definitions of a week of workdays and a weekend of nonwork days. Zerubavel argues that the weekly cycle, "which governs and regulates much of our everyday social life, actually represents man's first successful attempt to establish a social rhythmicity that is based upon an entirely artificial regularity" (1981, p. 11; 1985).

< Conventionalities seen as given >

However, conventionality does not mean that we can alter those four dimensions of temporality at our own will. Being conventional is different from being arbitrary. Once they are established, the sequences, durations, temporal locations and rates of recurrence are very often assumed as both given and intrinsic to situations and events. These conventions regulate and control our social life with their own force of objective entities. Zerubavel states "even though the sociotemporal order is based, to a large extent, on purely arbitrary social

[1] Here the term 'week' is not relevant because the term itself implies the seven day cycle. After the French Revolution, a new term 'decade' was invented to designate the new ten-day cycle as seen in chapter 1. Here the term 'week' is used to refer to a calendrical cycle between day and month.

convention, it is nevertheless usually perceived by people as given, inevitable, and unalterable" (1981, p. 42).

b. Schriber and Gutek

Schriber (1986) and Schriber and Gutek (1987) examined the existence of norms about time in organisations and tested for differences in temporal norms among organisations (individually and by type and size), work group types and occupations. Results showed, for example, that work group types differed in their perceptions of the length of work cycles and work rhythm patterns. Organisation types differed in the importance of schedules and deadlines and the efficient use of time. Schriber and Gutek reached a conclusion that time (strictly speaking, norms about time) is an underlying aspect of organisation culture which "can be thought of as a shared set of assumptions, beliefs, and values" (Schriber, 1986, p. 52).

For the comparisons among work groups and organisations, they developed an instrument to measure temporal norms, which employed the following dimensions. *Allocation* is the amount of time, whether planned or expended, devoted to a task or activity, regardless of when the amount occurs. It is based on a conventional standard of measurement (e.g., hours or minutes). *Scheduling* concerns the location of activities and tasks in the temporal realm (e.g., a 10:00 a.m. meeting), whereas allocation is primarily concerned with size or amount. It gives organisations a framework for constructing temporal boundaries, just as yardsticks give builders a framework for constructing physical boundaries. The temporal boundaries provided by scheduling can be further defined in terms of sequence, deadlines, punctuality, pace and buffers.

Sequencing is at the heart of the concept of scheduling. It refers to "actions follow[ing] one another in a prescribed order" (Moore, 1963, p. 8). *Deadlines* are also implicit in the concept of scheduling. Deadlines are temporal start and stop points, and can be external or internal to the task, or both. Deadlines for single-activity tasks are based on temporal constraints external to the task. Deadlines for interdependent tasks are based both on temporal constraints external to the final

task in the sequence, and on temporal constraints internal to the task sequence itself.

Punctuality is the degree of rigidity to which deadlines are adhered. Some deadlines require tasks to be completed on a certain day, others require completion by a certain hour of a specified day, and still others require completion by an identified minute of a particular hour. *Pace* is the rate at which activities can be accomplished. It is a measure of the speed of activity or the number of activities that can be done within a given interval of time. Allocation, scheduling and deadlines depend on pace.

Temporal buffers are unspecified amounts of time that are built into schedules to allow for the uncertainty in the estimated duration to accomplish a task. The necessity of buffers is evident in lags and delays, and they provide organisations with temporal elasticity. *Autonomy* is the amount of freedom the job holder has in setting schedules for the completion of his or her tasks over time. It measures the degree to which respondents perceive autonomy over the use of their time.

There are two types of temporal boundaries which are relevant to work and organisation culture. *Intraorganisational time boundaries* separate work groups from one another. The uses and meanings of time create group boundaries that indicate membership values, and expected behaviour patterns (Zerubavel, 1981, pp. 64-69). These boundaries separate work groups from one another. For example, workers in one department may habitually work under tight schedules and experience pressure to be punctual, whereas another department may have a more temporally relaxed atmosphere. *Time boundaries between work and nonwork* measures the amount of intrusion of job responsibilities into worker's personal time. For some workers, these boundaries may be more permeable than they are for other workers. For instance, some workers usually take work home with them, others do not.

The concepts of synchronisation and co-ordination contain temporal dimensions that apply to most work situations. They help frame the temporal concerns around the performance of multiple tasks or activities by individuals or groups. *Synchronisation* is managing the performance of more than one task simultaneously. Think, for example, of three people trying to free a car that is stuck in the snow. If each pushes on the car individually or in sequence there is little hope of moving the car. However, if they synchronise their activity, there is a better chance that they will successfully free the car. *Co-ordination* refers to managing the performance of more than one task in sequence. Thus, the car must be put in the proper gear before three helpful individuals begin to push.

Routinisation implies repetition at appropriate times - it has cyclical characteristics both in the content of the activity and its placement in a schedule. The expectation is for smoother and more accurate performance of the behaviour with each repetition, and perhaps for the eventual shortening of its duration or for an increase in pace. In addition, awareness of time use as a resource, future orientation and the norms regarding trade-offs between the quality of work and the speed of work over time (quality vs. speed) are suggested as dimensions of temporal norms which are important to understand organisation culture.

< Other dimensions >

There are other researchers who presented the dimensions of time. Gasparini (from Failla and Bagnara, 1992, p. 671) lists three major factors of time patterns in the analysis of work: the duration, the rhythm and frequency and the positioning of work time. Moore (1963, p. 8) insists that much of social behaviour depends for its orderliness on common definitions, assumptions and actions with regard to the temporal ordering, which has three elements: synchronisation, sequence and rate.

> Certain actions require simultaneous actions by a number of persons, or at least their presence at a particular time ... Thus one element of temporal ordering is *synchronization*. Other activities require that actions follow one another in a prescribed order; thus *sequence* is a part of temporal order. For still other activities, the frequency of events during a time period is critical; thus *rate* also is one of the ways that time impinges on social behaviour (p. 8).

As shown above, there is nothing new in comparison with dimensions which were suggested by Zerubavel and Schriber. Moore's three elements might have been a reference when Zerubavel made his own, and Gasparini's is just a modification of Zerubavel's. In fact, most of such classifications are modified repetitions of Zerubavel's. Schriber's work deserves to be noticed in that it supplies the comprehensive collection of aspects of temporality to date.

c. The contrast between Zerubavel's and Schriber's dimensions

Although sequential structure, duration, temporal location and rate of recurrence in Zerubavel's frame respectively correspond, though approximately, with sequencing, allocation, scheduling and pace in Schriber's, the two schemes of dimensions of time are contrasted with each other. In order to compare Schriber's and Zerubavel's dimensions of time, first we need to know Barley's distinction between structural and interpretative aspects of a temporal order. Whereas structural attributes refers to the external contours of a temporal system, interpretative aspects are concerned with what people perceive and interpret from the structural aspects[2] (Barley, 1988, p. 128). He explains the relationship between structural and interpretive aspects as follows:

> People employ these structural parameters of temporal order to make sense of events that occur in the course of their work. Interpretations so cast compose the internal parameters of a temporal world, parameters that are not as immediately obvious to a casual observer. By evaluating events against a shared scheme of expected sequences, durations, temporal locations, and rates of recurrence, people judge whether they are bored, whether something is wrong, whether they have done a good job, or whether others have acted responsibly. Such interpretations not only enable us to lend meaning to events in our work worlds; they lead us to form

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[2] Zerubavel also has a similar conception when he mentions the cognitive implications of temporal order.
"The temporal regularity of our social world has some very significant cognitive implications. In allowing us to have certain expectations regarding the temporal structure of our environment, it certainly helps us considerably to develop some sense of orderliness. By providing us with a highly reliable repertoire of what is expected, likely, or unlikely to take place within certain temporal boundaries, it adds a strong touch of predictability to the world around us, thus enhancing our cognitive well-being" (Zerubavel, 1981, p. 12). It reduces uncertainty. To put it another way, temporal regularity allows us to "carry in our minds a sort of 'temporal map' which consists of all our expectations regarding the sequential order, duration, temporal location, and rate of recurrence of events in our everyday life" (p. 14).

> opinions and make pronouncements about the behaviour of persons operating in alternate temporal systems (1988, p. 129).

In Barley's account, Zerubavel deals with "structural aspects of a temporal system" which can be described reliably by an independent observer, whereas Schriber is concerned with "interpretive aspects" which cannot be described easily by an observer. Schriber investigates "the perceptions of temporal rules and customs governing behaviour in work organization" (Schriber and Gutek, 1987, p. 644). She asks "what people in your organization think about time in the workplace" (1986, p. 274), and "what most people you work with expect" (p. 277). For example, whereas Zerubavel is interested in the amount of time actually spent to complete a task when he mentions duration, Schriber asks respondents to evaluate sentences about (the adequacy of) the allocation of time for tasks such as "We never seem to have enough time to get everything done" and "People expect to finish their work by the end of each day".

3. Dimensions of temporal order in the research

a. Characteristics of the research

The dimensions of temporal order which were investigated in this research are drawn from Schriber's and Zerubavel's works. These works provide a starting point for an empirical study of time and information technologies in organisations. Although the present research employs many of Schriber's dimensions of time, the characteristics of the research can be, paradoxically, revealed by the contrast with Schriber's; there are two fundamental differences between them.

First, this research is more interested in structural[3] aspects of temporal order than interpretative ones. In this sense, it is closer to Zerubavel's work. It does not mean that it ignores the importance of interpretative aspects. As Barley insists, structural aspects are necessary but insufficient conditions for facilitating social

[3] From now on, I will use the term 'external' in this context instead of 'structural' unless I use quotations. The terms 'structure' and 'structural' have too many implications as seen in terms such as 'structure and agent', 'structuralism' and 'structuration' so that there might be confusion. When Barley mentions 'structural aspects of temporal order', the word 'structural' means external things which can be easily observed. Structural aspects of the temporal order in work might be paraphrased as 'temporal structure of work'.

changes. Hence interpretative aspects should also be considered when we investigate, for instance, the effects of information technologies on temporality in organisations, and furthermore on social relations. However the author's belief is that the priority should be given to external aspects over interpretative ones. In general, interpretations follow, rather than precede, external changes. Therefore, in order to know the interpretative aspects of any change, we should investigate external aspects first. Whereas Schriber is only concerned with attitudes, ideas or perceptions of (norms of) time, the present research pursues external aspects of temporal order first, then pays attention to the perceptions of temporal norms. Normative aspects of temporality should be preceded by the study of the external aspects.

Second, this research may be referred to as dynamic, whereas Schriber's work is static. This research intends to trace changes in temporality caused by a new information system. Comparisons between before and after the introduction of the information system are made across temporal dimensions. It considers temporal order to be changeable. In contrast, Schriber tries to find the existence of temporal norms which dominate a specific organisation, and to compare among organisations and work groups. According to the classification scheme suggested in chapter 2, Schriber's work belongs in category III, while this research seeks to be in category IV.

In summary, what I intend to investigate first are *the changes* in *external* aspects of temporal order rather than people's perceptions of them. Then I will try to *interpret the meanings* of those changes in external aspects from both sociological and organisational points of view. In the latter stage interpretative aspects are investigated more thoroughly.

b. The criteria of selection and dimensions of time

The two differences functioned as the criteria by which some features are selected from Schriber's dimensions and others are abandoned. Future orientation, awareness of time use and quality versus speed are disregarded because they are concerned purely with perceptions of values or norms, with no reference in

external reality. Routinisation is also abandoned because it has more to do with the deskilling issue in labour process theory (Braverman, 1974) rather than the temporal one. Instead cycles and rhythms (Schriber, 1986) are selected and modified. Time boundaries between work and nonwork are disregarded because nonwork time is out of the scope of this research, which is only concerned with time in a work place. Although autonomy over the use of time is concerned with the interpretative aspects rather than external aspects, it is included because of its importance in evaluating changes in social relations. Others are accepted because they seem to be able to adapt themselves to trace external aspects of temporal order.

<1> Allocation

Allocation is concerned with the amount of time devoted to a task or activity. Each amount of time will be compared between before and after the use of information technologies.

<2> Scheduling

Scheduling concerns the location of activities and tasks at particular points over the continuum of time.

<3> Sequencing

The sequencing refers to the order in which activities and tasks take place. Here the importance of a specific order and the possibility of changing the order are examined.

<4> Deadlines

Deadlines are temporal start and stop points. The existence of deadlines and the importance of meeting deadlines are examined.

<5> Punctuality

It is the degree of rigidity to which deadlines are adhered. The importance of 'being punctual' and the unit of measuring punctuality are investigated.

<6> Pace

Pace is a measure of the speed of activity or the number of activities that can be done within a given interval of time. It concerns the speed of work, the autonomy to control pace and the people's expectation to work fast.

<7> Temporal buffers

Temporal buffers are unspecified amounts of time built into schedules to allow for the uncertainty in the estimated duration to accomplish a task.

<8> Autonomy

Autonomy is the amount of freedom the job holder has in setting schedules for the completion of his or her tasks over time. It measures the degree to which respondents perceive autonomy over the use of their time and the ability to set schedules.

<9> Synchronisation and co-ordination

They help frame the temporal concerns around the performance of multiple tasks or activities by individuals or groups. Synchronisation is managing the performance of more than one task simultaneously. Co-ordination refers to managing the performance of more than one task in sequence.

<10> Cycles

A cycle is a regular recurrence of events and processes. Each task has its own cycle. This means that each job is composed of a task or set of tasks that occur with periodic or temporal regularity. It is attempted to profile the cycles in work processes experienced over time.

<11> Rhythm

Rhythm refers to the alternation in the intensity of being busy. The degree of being busy varies through the work day. The intensity of work load increases and decreases alternately.

<12> Time boundaries within the organisation

The differences in the uses and meanings of time create group boundaries within organisations. They indicate membership, values and expected behaviour patterns. These boundaries separate work groups from one another. Any differences in temporal dimension described above among job groups or departments are sought after.

A pilot study using an interview scheme based on the above dimensions was conducted among Korean bank workers who were seconded to London. During the pilot study and the very early stage of the fieldwork, some of dimensions were found irrelevant for the purpose of the research, and others found to overlap with each other. The discovery led the author to review the dimensions of temporal order, and a substantial revision was made during the fieldwork. Therefore the dimensions described above are not those which were actually used as a basis in making the interview scheme for the whole session of the fieldwork. The process in which some dimensions were eliminated and others were modified forms an important aspect of the case study method, namely the interaction between data collection and constructs, which will be explained in the following section.

B. The Research Method

1. The case study strategy

a. The case study as a research strategy

This research employs the case study as a research method. It is important to realise that the case study is not a specific method of data collection, but a research strategy by which researchers can stay on the right track towards the destination where their research aims to arrive. There are several ways, or strategies of doing social science research: experiments, surveys, histories and the analysis of archival information, let alone the case study. When to use which strategy depends upon the following three conditions: (a) the type of research question posed, (b) the extent of control an investigator has over actual behavioural

events, and (c) the degree of focus on contemporary as opposed to historical events (Yin, 1994, p. 4). Yin identified some situations in which a specific strategy has an advantage over others. The case study method is more suited when 'how' or 'why' questions are being posed, when the investigator has little control over the events, and when the focus is on a contemporary phenomenon within some real-life context. Based on this understanding, Yin (1994, pp. 3-4) criticises the hierarchical view of research strategies which has insisted "that case studies were appropriate for the exploratory phase of an investigation, that surveys and histories were appropriate for the descriptive phase, and that experiments were the only way of doing explanatory or causal inquiries." He argues that "what distinguishes the strategies is not this hierarchy but three conditions." Therefore there may be exploratory case studies, descriptive case studies, or explanatory case studies. It is a misconception to consider the case study as the exploratory stage of some other type of research strategy. Another widespread misconception is to identify the case study strategy with qualitative research. This fallacy is typically revealed in confusing case studies with ethnographies or participant-observation. Case studies can include quantitative as well as qualitative evidence (Yin, 1994, p. 14; Eisenhardt, 1989, p. 538).

In information systems research, the case study method has become a focus of methodological discussions (Mumford et al., 1985; Benbasat et al., 1987; Cash and Lawrence, 1989; Lee, 1989; Smith, 1990). Benbasat et al. (1987, p. 370) present three advantages which the case study has in information systems research. First, the researcher can study information systems in a natural setting, learn about the state of the art, and generate theories from practice. Second, the case method allows the researcher to answer "how" and "why" questions, namely to understand the nature and complexity of the processes taking place in work places. Third, the case approach is an appropriate way to research an area in which few previous studies have been carried out.[4]

[4] Benbasat et al. (1987) appear to be very cautious in selecting an appropriate expression for the last advantage in order to avoid the criticism of the hierarchical view. According to their evaluation of case studies conducted in information systems research, most of them were used for exploration and hypothesis generation, not for providing explanation and testing hypotheses. Judging from the early stage of information systems research, namely from the fact that there are many areas still unresearched, the case study

b. Why is the case study method selected for this research?

Based upon Yin's three conditions, I consider that for this research, an exploratory study on temporal implications of information systems on organisational work, the case study method is the most appropriate strategy. First, this research tries to answer 'how' information technologies affect the temporal order of the work which is conducted through KTNET, an EDI application. Second, there is no way in which we can control actual behavioural events taking place in the site of interest, where KTNET is being implemented and used. There is no variable which can be systematically manipulated in the case study site. In experiments the investigator focuses on a few isolated variables of interest assuming that all the remaining variables are constant or under control. Most phenomena in social and organisational settings have already taken place before the investigator enters or are taking place in front of him in a very complicated way. There are few variables that he can put under his control. What he can do is to trace them. So is the case with the sites where the author entered for the fieldwork. Third, as a study on the effects of information technologies, this research focuses on contemporary events rather than historical ones. As this research is interested in changes in work procedures caused by KTNET, it deals to some extent with how the work was done in the past before KTNET. More emphasis, though, is put on current situations and past events are viewed from the present point for the purpose of comparison.

< Interaction of data analysis and data collection >

Through a case study, as Benbasat et al. (1987) advocate, we can learn about the state-of-the-art information technologies, and build a theory from the field (Eisenhardt, 1989). More importantly, as revealed in the literature review, time itself has been rarely explored in either organisational studies or information systems research. Studies are even more sparse when we turn to the narrower issue of the relationship between time and information technologies. For such unexplored subjects, the case study method helps us discover new concepts and relationships between those concepts for further research. In that sense, this

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method may be a legitimate way of adding to the body of knowledge of this field. Benbasat et al. emphasise, however, that exploration is not the only reason for applying the case study method.

research carries mainly an exploratory nature. When doing an exploratory case study, it is important to maintain the overlap of data analysis with data collection, which allows researchers to take advantage of flexible data collection (Eisenhardt, 1989, p. 539). A key feature of exploratory case studies[5] is the freedom to make adjustments during the data collection process. These adjustments can be the addition of cases, the modifications of data collection instruments such as the addition of questions to an interview scheme, and the addition of data sources such as the addition of surveys. These alterations are justified because in exploratory case studies,

> investigators are trying to understand each case individually and in as much depth as is feasible. The goal is not to produce summary statistics about a set of observations. Thus, if a new data collection opportunity arises or if a new line of thinking emerges during the research, it makes sense to take advantage by altering data collection, if such an alteration is likely to better ground the theory or to provide new theoretical insight (Eisenhardt, p. 539).

In the same vein, turning back to the beginning stage of the research, although an initial definition of the research questions and a specification of constructs are useful for the further progress of the research, it is equally important to recognise that both are tentative in this type of research (Eisenhardt, 1989, p. 536). Such flexibility is true of the whole case study design as well (Yin, 1994, p. 52).

c. Modified dimensions of temporal order

This characteristic of the exploratory case study, namely the flexible interaction between data analysis and data collection, was quite important in this research. The author entered the fieldwork sites with the 12 temporal dimensions which were described in the previous section. They were derived from Zerubavel (1981) and Schriber (1986; 1987 with Gutek). The initial interview scheme was based upon the twelve dimensions and some research issues. These latter will be presented in the following section.

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[5] Eisenhardt uses the term 'theory-building', which corresponds approximately to 'exploration' or 'hypothesis generation', although it is not quite the same. It is the previous stage of 'explanation' or 'hypothesis testing' in the knowledge building process. For a detailed comparison of terminologies, see Benbasat (1987, p. 372).

The scheme was tested in a pilot study in which two Korean bank workers seconded to London branches were interviewed. They were familiar with business procedures for foreign trade at least within the scope with which banks are concerned. In the pilot study, the interviewees raised questions about the relevance of some dimensions. They stated that some dimensions overlapped so that they found it difficult to distinguish each dimension both conceptually and empirically. Definitions of some dimensions were confusing at a conceptual level, and they thought they could not find something external corresponding to those concepts of dimensions given their experiences in working environments. After the pilot study, it was recognised that some dimensions should be revised. Given the lack of previous research on time in management and organisational studies, however, it was decided that it was better to enter the field, see facts, and modify the constructs than to make corrections through literature (re)review and pure imagination. What I thought was needed were vivid experiences in real working environments.

Before substantial work started in the fieldwork sites, I examined those tentative concepts. As I had more conversations with IS personnel and workers, had more opportunities to see how they worked, read more documents, and thereby became familiar with the fieldwork sites - work procedures, environments and people, it became clearer what the problems were with some dimensions, and I was able to decide what to keep, what to throw away, and where to modify. The reasons for the changes are as follows.

Allocation, which is defined as the amount of time devoted to a task or activity, is replaced by duration as is used by Zerubavel. Allocation is discarded because the term implies that it is decided beforehand by schedules or by persons who make the schedules. Duration is concerned with the amount of time spent to complete a task or activity and answers the question of how long it actually lasts in practice.

Scheduling is replaced by temporal location. Scheduling is the combination of a variety of temporal aspects in that schedules and timetables are based on duration, temporal locations, deadlines and so on. Therefore scheduling is not a

suitable word for its definition of the location of activities and tasks at particular points over the continuum of time. Temporal location is employed instead. It concerns when activities take place.

Sequencing undergoes a minor change into sequence. Sequencing implies that the order of tasks or activities can be planned by actors. It is an aspect of what sequence addresses. Sequence refers to the order in which activities and tasks take place.

Deadline stays with some change of its definition. It refers to the fixed time by when work is to be done.

Punctuality is excluded because it does not have an external representation to be traced. Punctuality is a norm. In addition, people in the sites did not think that the importance of punctuality could change by the new system. The notion of punctuality is not considered relevant for research which investigates the external dimensions of temporal order. It is partly addressed when deadline is examined.

Pace is the rate of occurrence which is concerned with how often situations and events take place within a given interval of time. It is a measure of the speed of activity. According to Zerubavel, when events occur repeatedly and regularly, they entail cycles. In this research, therefore, pace is not dealt with separately but included in the dimension of cycle.

Temporal buffers are discarded. Everybody I spoke to in the pilot and field sites failed to be aware of temporal buffers. They were confused and asked for further explanation. I was not able to find things such as temporal buffers which were unspecified amounts of time built into schedules to allow for the uncertainty.

Autonomy is excluded because it is not an external aspect of temporality. It is rather what can be derived from the changes in external temporality, and what can be understood from the interpretation of social relations which have temporal

implications. Such interpretation is attempted in the fieldwork but autonomy is not dealt with as a separate dimension.

Synchronisation and co-ordination are excluded. The tasks under study in export administrative work are ordinary and relatively simple. They do not require the synchronised performance of multiple tasks by multiple persons. They often require the involvement of several persons working in a co-ordinated sequence for their completion. Because the co-ordinated sequence is in a simple form, however, it is covered in the sequence above. In summary, synchronisation and co-ordination cannot be traced in the fieldwork sites.

Cycle remains without any change in its definition of the periodic regularity in which work is completed repeatedly.

Rhythm also remains, referring to the alteration in the intensity of being busy.

Time boundaries with organisations is excluded for the same reason given for autonomy.

In summary, the originally proposed 12 dimensions were reduced to six. They are duration, sequence, temporal location, deadline, cycle and rhythm (Table 3-1). Given the six dimensions, the basic procedure of the fieldwork was first to investigate external changes in the six dimensions after the introduction of KTNET, and then it was attempted to analyse or interpret social and organisational meanings of those changes.

Table 3-1. Six dimensions of temporal order

Original 12 Dimensions	Modified six Dimensions	Definition
Allocation	Duration	the amount of time spent to complete a task or activity
Scheduling	Temporal location	the location of activities and tasks at particular points over the continuum of time
Sequencing	Sequence	the order in which activities and tasks take place
Deadline	Deadline	the fixed time by when work is to be done.
Punctuality	excluded	
Pace	excluded	
Temporal buffers	excluded	
Autonomy	excluded	
Synchronisation & co-ordination	excluded	
Cycle	Cycle	the periodic regularity in which work is completed repeatedly
Rhythm	Rhythm	the alternation in the intensity of being busy
Time boundaries	excluded	

2. The research design

a. Multiple embedded cases design and the unit of analysis

According to Yin (1994), there are four types of designs for case studies. They are single-case holistic, single-case embedded, multiple-case holistic and multiple-case embedded designs (Figure 3-1). Single- and multiple-case studies reflect different design situations, and within these two types there are also a unitary or multiple units of analysis.

Figure 3-1. Basic types of design for case studies

	single-case designs	multiple-case designs
holistic (single unit of analysis)	**TYPE 1**	**TYPE 3**
embedded (multiple units of analysis)	**TYPE 2**	**TYPE 4**

Single case designs are used when the case represents the critical case, an extreme or unique case and the revelatory case, whereas multiple-case designs are employed on the basis of the replication logic, i.e. for a more theoretical purpose. In multiple case studies, each case is carefully selected because it either predicts similar results or produces contrasting results but for predictable reasons. The former is for a literal replication; the latter for a theoretical replication. In either single-case design or multiple-case design, one case study may involve more than one unit of analysis. This occurs when, within a case, attention is also given to a subunit or subunits. In an organisational study, the embedded units might be "process" units - such as meetings, roles or locations (Yin, 1994, p. 41).

< The unit of analysis >

This research takes the multiple-case embedded design (Type 4) of three cases. They are the departments affected within three companies: Daewoo, Sunkyong and Korea Exchange Bank. They were selected to study how the introduction of KTNET had changed work procedures within them. Of the export administrative business, four domains to which KTNET had been applied were

selected; export letters of credit advice, export licence, local letters of credit and negotiations.

The unit of analysis is determined by the way the research questions are defined (Yin, 1994, p. 22). The main question of the research is 'how do information technologies change the way work is done?', more specifically 'how does KTNET affect the temporal order of work in export administrative domains in trading companies and banks?'. Therefore the unit of analysis is each domain in each company or each division affected within each company. I call these sub-domains. Figure 3-2 shows ten units of analysis of the research. As will be explained later, Sunkyong had not developed the negotiation system when the fieldwork was conducted and temporal changes as regards negotiations in Korea Exchange Bank were minimal. Therefore the two sub-domains were not dealt with in the research. In Chapter 5, the ten sub-domains will be described and their temporal dimensions will be analysed in the order of their numbers in the table.

Figure 3-2. The units of analysis: sub-domains

Domain / Case	Export L/C Advice	Export Licence	Local L/C	Negotiation
Daewoo	Sub-domain 1	Sub-domain 4	Sub-domain 7	Sub-domain 10
Sunkyong	Sub-domain 2	Sub-domain 5	Sub-domain 8	
Korea Exchange Bank	Sub-domain 3	Sub-domain 6	Sub-domain 9	

Each sub-domain consists of procedures. They represent the steps to be followed to complete the work required in the sub-domain. Each sub-domain or part of it is a task to be conducted from the viewpoint of a worker in charge. In the same way, each procedure is a unit task for the worker. A unit task is the smallest element of each task in a conceptual sense, not in a physical sense. We can divide each unit task into even smaller elements physically as the advocates of time and motion study of work do. This is not what this research intends to do. It is the

smallest unit such as the key informants and the workers involved perceive. It is the way they perceive and describe their work.

This research uses the concept of literal replication in the selection of cases. Three organisations and four procedures within them were selected in the anticipation that KTNET would make similar impacts upon them. When more research on time and information technology like this one accumulates, more elaborate research, based on the theoretical replication, will be possible. Another reason for multiple cases lies in the nature of trading businesses. As will be described in the following chapter, the letter of credit (L/C) opening, for example, is not completed within one organisation. It requires at least two transaction partners: a trading company and its partner bank. This characteristic of the work also provides us with the opportunity to take into account temporal implications in inter-organisational relations.

b. Selecting the sites

As the research topic narrowed down to the temporal order of organisational work and a few research questions appeared as presented in the next section, the author began to search for suitable sites for the research. The Korea Trade Network (KTNET) was selected mainly for the following reasons.

Currently, information systems in organisations have a long history. It is difficult to track down the impacts of old systems. People forget easily what life was like in the past and tend to take for granted what exists today. Therefore a relatively new application is needed so that investigators can trace changes in the way work is done in as much detail as possible. KTNET is a recently developed and introduced application. It started as a test in November 1992, and commercial services began in January 1994. It was thought that shifts related to the temporal order in work would still be traceable.

In addition, many of the information systems developed so far seem to present themselves as the means of time saving. This is extremely conspicuous in KTNET which boasts itself as the vehicle for time saving. KTNET was developed

to reduce radically time being spent for administrative work in trade affairs. At the risk of over-simplification, the main objective of KTNET is to conquer time. From the viewpoint of this research, which intends to investigate changes to the temporal order of work in organisations, it is thought that it may be more important and easier in KTNET than in any other information system to investigate and show how work is structured and transformed by information technology in a temporal sense. Since time saving is emphasised strongly in the KTNET project, it can give us more insight into temporal changes in work places, not just the simple fact of time being saved.

The Daewoo Corporation, Sunkyong Limited and the Korea First Bank were selected as sites of the research. Both Daewoo and Sunkyong are names of large company groups, called 'chaebol' in Korean. The Daewoo Corporation and Sunkyong Limited are the core companies and their trading arms of the respective groups. The two companies participated in the KTNET project from the beginning, and put it into use as early as February 1993, although the full-fledged service of KTNET began in early 1994. In particular, Daewoo is considered as KTNET's model company. Its case was reported in 'EDI World' and 'EDI Post' magazines published in Korean (Lee, 1994, 1995). The Korea Exchange Bank (KEB), as its name implies, specialises in foreign exchange. It has also been an active participant in the KTNET project and is considered to be both the most advanced and the largest user among banks. KEB was also selected because it is one of the important banks which transact with Daewoo and Sunkyong. Detailed information on the companies will be presented in the next chapter.

c. Data collection methods

A major strength of the case study method is the availability of multiple data collection methods such as interviews, documentation, observation, archival records and physical artefacts. Combined together, they can provide us with a richer picture of the phenomenon under study than when any single method is used. However the most important advantage of multiple data collection methods is "the development of converging lines of inquiry, a process of triangulation" (Yin, 1994, p. 92). Any finding or conclusion in a case study is much more

convincing and accurate if it is based on several different sources of information in a corroboratory way. In the information systems area, many researchers also advocate the multiple use of data collection methods, insisting that "it is always best to utilise several methods of data collection to address adequately the impacts of information technology" (Gable, 1994, p. 114).

In this research, data were collected from internal documents and through interviews and observations. At the beginning of the field work, I collected as much material (primary and secondary) as I could to enhance my knowledge of work procedures in the companies. At the same time, I conducted unstructured interviews with IS persons in charge of the KTNET implementation in their own companies, focusing on how work had bee changed by this new information technology. Then semi-structured interviews were conducted with workers whose work was affected. Observations were conducted in two ways: relatively formal and informal. In the negotiation fieldwork, one and half days' observation in the office and attendance at a half day's training session were made with permission. In the rest of the areas, observations were made informally while visiting offices for interviews and other business. The observation was the most difficult and demanding method to perform in that it requires continuous attention and a high degree of sensitivity. The role of observation was limited to a complementary one in this research. However the observations provided good opportunities to gain knowledge of the work processes, which I could not have had without them. In other words, the observations were valuable in that they gave me a clear idea of what could be done and what could not be done. For example, during the observations, it was found that many of the dimensions of time overlapped each other.

3. Conducting the field work

a. Getting access

When I arrived in Seoul in September 1995 to conduct the fieldwork, I contacted one member of the staff in Information Systems Division at Daewoo Corporation. He had written two articles (Lee, C., 1994, 1995) in an EDI-related magazine about his company's experience in developing KTNET and had been

responsible for the KTNET project in the company for three years. I explained to him the purpose of the research and asked for co-operation. Then he suggested that I could join a new project, the negotiation EDI system, which was a part of the whole KTNET development in the company. He was worried about, and interested in, organisational issues involved in the systems development. I visited him several times after this, and he explained the project under process in detail. As the number of meetings with him increased, our rapport grew and I became familiar with both the company and its working environment.

Access to the other two companies was made via the introduction by the informant in Daewoo. First he introduced me to one member of the staff in the KTNET company, who has many counterparts in KTNET's user companies. He asked his counterparts at both the Korean Exchange Bank and Sunkyong for co-operation with my project. Then I met two IS persons in the companies who had been in charge of the development and implementation of KTNET from the beginning in their companies. Both were good informants; they had all the knowledge as far as the project is concerned in their company, and full command of the project. One of them was an author of an article in an EDI magazine, which reported on his company's trade automation case. Both of them were willing to allow time for interviews and make arrangements for interviews of other workers.

b. Doing the fieldwork

The fieldwork took about five months from September 1995 to January 1996. During that period, 25 interviews with 19 persons and several observations in three organisations were made. Interviews lasted an average of 40 minutes. In addition to the interviews, a number of (informal) meetings were held with the three key informants. The meetings often took place when I visited their offices before or after interviews, and some meetings lasted up to three hours in a quiet atmosphere. Of 19 interviewees, only five are male. Female workers were more affected by the new system[6].

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[6] Zuboff (1988) distinguishes between 'automating' and 'informating' powers of information technology. The technology is characterised and distinguished from earlier generations of machine technology by its fundamental duality. It not only imposes information (in the form of programmed instructions) but also produces information. It

The meetings with the informants were important. They were excellent informants. They knew inside out the whole processes related to KTNET on both sides, as a clerical worker in offices (branches) who uses the system and as an IS person who develops it. In addition, they were so cooperative as to arrange interviews and observations. However, their co-operation did not guarantee the success of the interviews in the field. Although interviews were arranged beforehand, it was difficult for an outside researcher to conduct stable interviews and observations in working environments of busy offices. Interviews were conducted in offices or meeting compartments next to the offices. They were often interrupted by telephones, calls and so on. Even in meeting compartments, most interviewees did not allow enough time to finish what I intended to ask because they were very busy and always pressed to do something. My tactics to overcome this weakness were to have as many conversations, though informal, as I could with the main informants. I supplemented what I felt had lacked in interview results with these conversations.

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both accomplishes tasks and translates them into information. While the technology can be applied to automating operations according to a logic of the nineteenth-century machine system, it simultaneously generates information about the underlying productive and administrative processes through which an organization accomplishes its work. Thereby it provides a deeper level of transparency to activities.

From the viewpoint of Zuboff's distinction, this research is more concerned with the automating power of KTNET than the informating one. For KTNET at its early stage, the automating potential seems to be more important than the informating one. In the three companies of the fieldwork sites, therefore, KTNET affects the lower stratum of their workers who are in charge of routine operations. Since the division of labour is drawn, first of all, by gender, most of interviewees were female.

C. Research Issues

In the previous section I presented some works on dimensions of time, and selected the six dimensions upon which the empirical work of the research is based. The interview scheme was made focusing on how KTNET affected each dimension of time. Although this research is exploratory, simple observations of changes in each dimension are not sufficient. The following research issues have been developed from some works which I described in the previous chapter on literature review. They carry social and organisational implications. In this section, I present those issues towards which research effort will be directed.

As described in Chapter 1, Barley (1988) determined that the new radiological technologies increased the monochronicity of radiologists, and thereby increased the degree of symmetry between the temporal organisation of radiologists' and technologists' work. In contrast, I expect that information technologies in office environments are likely to increase the polychronicity. Information technologies seem to enable people to engage in several activities at the same time. Then what makes it possible? I suggest that it is made possible by the increased flexibility which information technologies provide for work processes. We can get several things done at the same time when some of them are free from, that is, flexible in, time and space. Information technologies can free many activities from, for example, rigid sequences and cycles which have been traditionally fixed firmly (Failla and Bagnara, 1992). In a word, information technologies increase flexibility in work procedures.

The relationship between information technology and organisational flexibility was studied by Lucas and Olson (1994), who argued a similar point. Some systems, for example, EDI at discount stores, make an organisation appear more flexible to customers by reducing cycle times, the time it takes to complete a task. Flexibility is defined as "the ability to adapt when confronted with new circumstances; a flexible organization defends quickly against threats and moves rapidly to take advantage of opportunities" (p. 156). Information technology can affect organisational flexibility in three major ways.

> 1. IT can alter the time and place of work, generally by changing boundaries on **where** tasks are accomplished and removing constraints on **when** tasks are performed.
> 2. IT affects the nature and pace of work; most often it **speeds up** the processing of information.
> 3. IT enables the firm to **respond quickly** to changing market conditions (p. 157, bold in original).

Although Lucas and Olson (1994) do not directly deal with time, their explanation of how information technology alters flexibility reveals that time is a key characteristic of flexibility. As shown above, time is the keyword as far as flexibility is concerned. The three of them include the words implying time: altering the time of work by removing constraints on when tasks are performed, the pace of work, speeding up the processing of information and responding quickly. Therefore we can insist that information technologies shift organisational flexibility by affecting temporal aspects of work.

However increased flexibility is not gained by every organisation employing information technologies. Information technologies have only the potential to alter flexibility in organisations. There is a paradox between technological and organisational flexibilities (Lucas and Olson, 1994, p. 157). Technological flexibility does not guarantee organisational flexibility. Technology can contribute to organisational flexibility, but information technologies themselves are often inflexible. The technology that provides flexibility soon becomes old and hard to maintain, and the organisation tends to become more inflexible as time goes by. Many flexible systems are complex and difficult to modify. Information technologies are especially complex, and the complexity reduces the flexibility of specific information technology applications. In conclusion, the technological flexibility realised by information technology does not always lead to the organisational flexibility. The outcome of information technologies in terms of the organisational flexibility on the whole could be positive or negative, and its evaluation depends on the observer's position (p. 160).

Although Lucas and Olson deal with the issue of information technology and organisational flexibility relevant to this research, and provide some researchable ideas about time, their purpose of the research is different from that of

this research. While their focus is laid on the flexibility of an organisation as a whole, in this research attention is given to organisational work. This research does not deal with organisational flexibility because it implies more than what this research intends to study, namely temporal changes in organisational work. Instead of the 'organisational flexibility', therefore, I suggest that we distinguish internal and external flexibilities. The division appeared in Failla and Bagnara (1992, p. 672) when they stated;

> the organizational changes imposed by the new technologies do not relate solely to the 'external' flexibility of work (for example, the decentralization of production activity and the flexible use of human resources) ... Information technology has also generated 'internal' work flexibility, more or less explicitly modifying traditional time-frames, the 'hidden rhythms' (Zerubavel, 1982).

They did not provide clear definitions. I suggest that internal flexibility refers to flexibility in the work process itself. It is the direct result of the transformation of work by information technologies, which is mainly grasped in terms of temporality. On the other hand, external flexibility means flexibility extended beyond the work processes to the whole organisational horizon. It is partly a result of internal flexibility. It may refer to a wide range of ability from the ability to adapt to changing environments, to decentralise the production activity and to use human resources flexibly in a broad sense, to the ability to work smoothly, for example without bottleneck, across functional units within an organisation in the narrow. However, as Lucas and Olson's distinction between technological and organisational flexibilities suggests, external flexibility does not necessarily go hand in hand with internal flexibility. External flexibility is influenced by information technologies as well as other factors. It is determined by other factors to the same extent as it is influenced by internal flexibility.

From the above discussion, we can identify some issues on which research effort will be concentrated. I do not claim that information technologies increase the global flexibility of an organisation as Lucas and Olson argue. It is beyond the intended scope of the research. Instead I suppose that information technologies increase the internal flexibility, which can be expressed in terms of temporal

dimensions. This internal flexibility is not expected to bring in automatically external flexibility. In this research, the narrowest aspect of the external flexibility is addressed rather than broader ones. It is the ability to work smoothly across functional units without bottleneck.

The increase in the internal flexibility is likely to give rise to the increase in polychronicity, unlike Barley's case of radiological departments. Schein (1992, p. 108) suggests that while monochronic time is well suited to the management of large systems and is the form of time which is taken for granted in most organisations as the only way to get things done efficiently, polychronic time is more suitable for the early stages of an organisation, for smaller systems and for organisations where one person is the central point of co-ordination. Although Schein's suggestion could be right for the past with less information technologies, now information technologies have been rendering such an argument less meaningful. Increased flexibility through information technologies contributes to the increase in polychronicity in most work situations. Here a point needs to be made as regards the usage of both terms, monochronic and polychronic. The division between them should be understood in a relative sense. It is absolutely impossible to do two things at the same moment. Furthermore, they are often inseparable when individuals, groups or organisations conduct business. Sometimes they deal with one thing at a time; in other times, required by the situation, they do several things at a time. Therefore it is reasonable that information technologies have a tendency to make more activities subject to the polychronic way.

Barley's work does not limit itself only to descriptions of changes in temporal order. What he intends to do ultimately through his examination on temporality is to investigate how social relations among professional groups are affected by the new technology. This research shares the same purpose. It will try to interpret social and organisational implications of changes in temporality in work places. In addition, as this research deals with EDI technology which is inter-organisational systems, an attempt is to be made to search for any impacts on inter-

organisational relations from the temporal point of view. In summary, the following issues will be addressed in the research.

1> Does KTNET increase flexibility in organisational work? How is flexibility manifested in temporal terms?

2> Is the internal flexibility accompanied by an increase in external flexibility?

3> Does KTNET tend to increase or decrease the polychronicity in work places?

4> Do temporal shifts caused by KTNET make any changes in social relations within organisations?

5> What implications does KTNET have in the inter-organisational relations among participating organisations? Is any temporal adjustment among organisations required by KTNET?

PART II.

Temporal Changes in KTNET

In Part I, an aspect of time which has not been well recognised in information systems research was considered. The main argument presented in Chapter 1 is that our perceptions of time, organisation of time and ways of living and working (described from a temporal point of view) can be transformed by the increasingly dominant application of computers to every facet of human life, just as the mechanical clock affected them in the seventeenth and eighteenth centuries. In Chapter 2, studies on time in management and organisational research were reviewed. A scheme for classification was introduced. By intersecting the concepts of time and the functional roles of time in research design, four categories were presented, in which each study was positioned. Although some time-related research has been done in management and organisational studies, there is a disproportionate number of studies in each category, with only a handful of studies in category IV. Furthermore, when it comes to the relationship between time and information technology, only a couple of studies with empirical substance are available. In Chapter 3, the six dimensions of time were developed from the previous research as conceptual tools by which changes in temporality of work are to be traced. Then reasons why the case study was the selected research method were explained and the way the fieldwork proceeded was presented. In the last section, the five research issues were raised. They were partly developed by the author and partly derived from some of the previous research.

Based on the theoretical and conceptual discussions described in Part I, the issue of how temporality is affected by information technology is addressed in Part II by focusing on real organisational work situations. Part II consists of four chapters. Chapter 4 presents some background knowledge of the work analysed in the research, that is, international trade. Then it gives a brief introduction to the Korea Trade Network, an EDI (electronic data interchange) technology. It is applied to international trade business in Korea to facilitate documentation procedures which are known for their complexity and for the enormous amount of work involved in

them. In section 3, the organisational backgrounds of the three companies where the fieldwork was conducted are presented. In Chapter 5, four main tasks of export procedures are described focusing on differences between procedures before and after the introduction of KTNET. Then changes in the six dimensions of temporal orders of each task are traced. Chapter 6 summarises shifts in the six dimensions and addresses the research issues raised in Chapter 3 in the KTNET environment. It investigates sociological and organisational implications of temporal changes caused by the new information technology. Chapter 7 concludes the thesis, presenting its summary, limitations and suggestions for further research.

Chapter 4
KTNET and Organisational Backgrounds

This chapter provides the background for descriptions and analyses of EDI in trade automation and of changes in organisational work. It first explains mechanisms of international trade, focusing on letters of credit (L/C), the most common form of international payments. Then it shows the development of Korea Trade Network (KTNET), an EDI application for trade automation. Its background and history, structure, procedures of export and import via KTNET, and the current state of its diffusion are briefly covered. Finally it describes the companies in which case studies were conducted. Their general profile, organisational charts, working practices, and the use and impact of the new technology will be provided.

A. Introduction to international trade

International trade is a complex process (Giddy and Ismael, 1983, p. 3). It is complex because it involves at least two transactional parties which are located in two countries with different currencies and jurisdictions. Furthermore, payments must be made at a distance and across time. The exporter, the importer or both need credit during part or all of the period from the initial manufacture of goods by the exporting firm to the time of the final sale and collection by the importer. All these conditions require the extensive, often tedious, documentation for the international transfer of goods and payments. A number of methods such as drafts of foreign buyers, letters of credit and bankers' acceptances have developed to handle payment for international trade. Although there are as varied ways of payment as the content and destinations of a nation's exports, the most common way to assure payment is to obtain a letter of credit.

1. Letters of credit

"A letter of credit is a document issued by a bank at the buyer's (importer's) request in which that bank promises to pay the seller upon presentation of

documents as specified in the terms of the credit" (Giddy and Ismael, 1983, p. 12). There are four parties involved in a letter of credit: the buyer (the applicant), the buyer's bank (the issuing bank), the issuing bank's foreign correspondent (the advising bank) and the seller (beneficiary). The basic of letter of credit is a bank-issued instrument which promises its agreement to make payment to a seller when the buyer satisfies certain stipulated conditions. When those conditions are fulfilled, the advising bank is obligated to pay the seller. It shifts the risk of non-payment for goods delivered from the seller to financial markets (Lemle, 1983, p. 4).

Letters of credit are extensively used. Certain countries, particularly in the Far East, require that all export trade be conducted on a letter-of-credit basis (Giddy and Ismael, 1983, pp. 18-19). Some sellers sell goods only on a letter-of-credit basis because it reduces the commercial risk to them. The buyer also receives some assurance that the seller will comply with the negotiated terms of the sale, because the seller cannot receive payment until the required documents are submitted. Another important reason for a buyer is to eliminate delays involved in establishing the buyer's own credibility, which is particularly useful for a buyer without experience in international trade. This credibility is so important that new importers are generally required to obtain letters of credit.

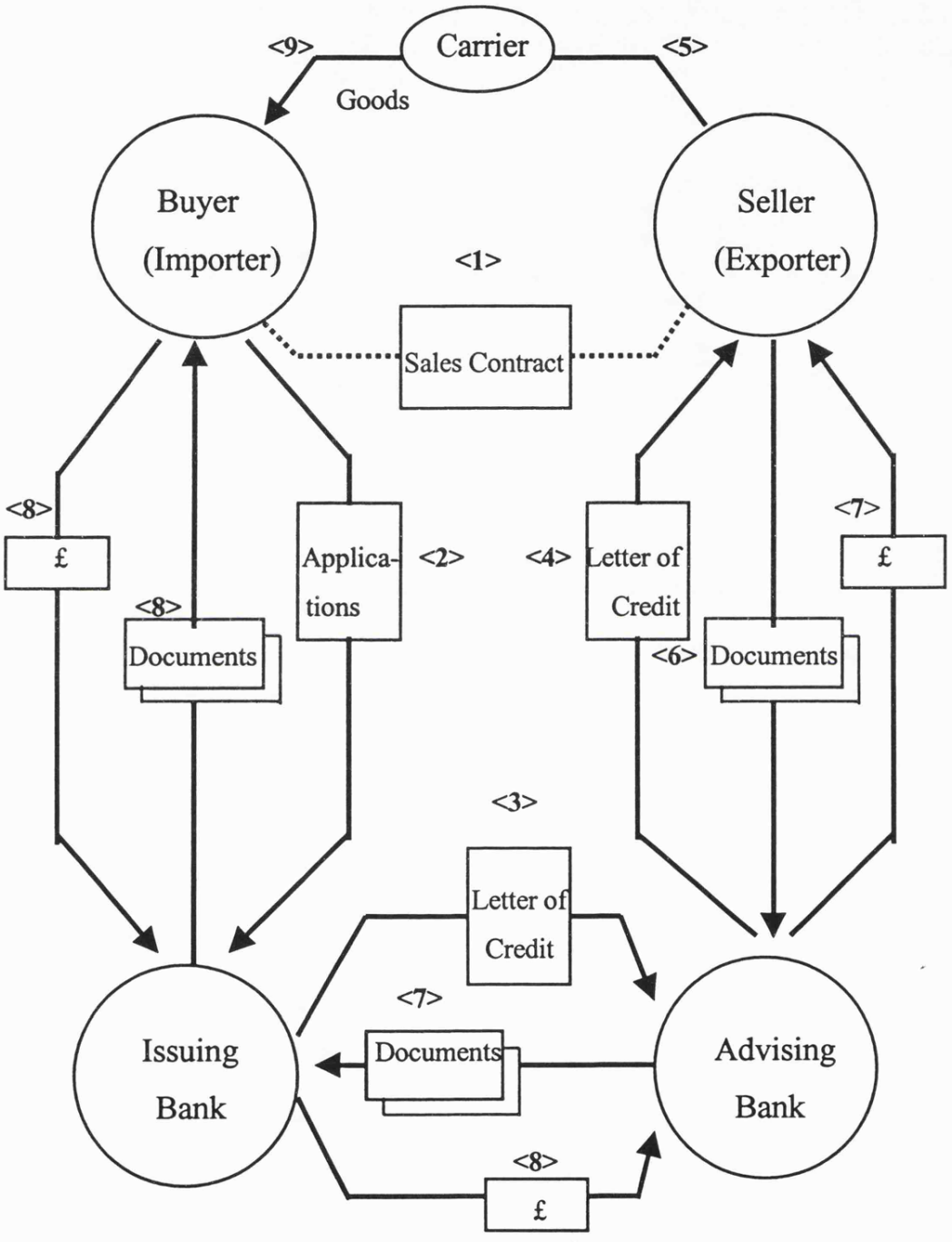
2. The letter-of-credit cycle

International trade by letters of credit forms a cycle, which involves the exchange of documents and money through intermediaries. Table 4-1 shows the basic steps needed to complete a letter-of-credit cycle (see Figure 4-1).

Table 4-1. Nine steps in the letter-of-credit cycle (from Giddy and Ismael, 1983, pp. 14-15)

Step 1: The buyer and seller agree upon the terms of sale. The sales contract dictates that a letter of credit is to be used to finance the transaction.
Step 2: The buyer completes an application for a letter of credit and forwards it to the bank that will issue the letter of credit.
Step 3: The issuing bank then forwards the letter of credit to a correspondent bank in the seller's country.
Step 4: The advising bank relays the letter of credit to the seller.
Step 5: Having received assurance of payment, the seller makes the necessary shipping arrangements.
Step 6: The seller prepares the documents required under the letter of credit and delivers them to the advising bank.
Step 7: The advising bank negotiates the documents. If it finds them in order, it sends them to the issuing bank. If the advising bank is designated as the paying bank, it pays the seller in accordance with the terms of the letter of credit.
Step 8: The issuing bank, having received the documents, examines them. If they are in order, the issuing bank will charge the buyer's account and send the documents on to the buyer. The issuing bank also will reimburse the advising bank.
Step 9: The buyer receives the documents and picks up the merchandise from the shipper (carrier).

Figure 4-1. The letter-of-credit cycle



B. Korea Trade Network

1. Trade automation and EDI

a. The concept of trade automation

As the world economy becomes more trade dependent, the volume of international trade is growing enormously to the extent that paper-based administrative systems cannot keep up with it properly. Paper-based systems are slowing down trade, and international trade, therefore, is going towards the paperless age with EDI.

Trade automation means paperless trade procedures in which transactions are processed by the content of documents in electronic document form. The content of documents is transmitted through data networks instead of paper documents delivered in person or by post. When trade automation is completed, transactions can be immediately processed between originating and receiving offices through electronic networks. It may remove the physical delivery of documents among banks, trade-related institutions, customs offices, trading companies and so on, which normally requires several weeks. It also eliminates many repetitious operations.

b. Electronic data interchange

The trade automation project in Korea is based on an application of electronic data interchange (EDI) technology. EDI is defined as "the inter-orgnizational, computer-to-computer exchange of business documentation in a standard, machine-processable format" (Emmelhainz, 1993). There are four key points in the definition that distinguish EDI from other forms of paper or electronic communications.

<1> Inter-organisational

EDI takes place between companies. While the last 30 years have seen a significant growth in the use of computer systems *within* companies, the same trend did not occur *between* companies. Only recently a focus on inter-organisational communications has taken place. While the technology of EDI can

be used internally, for example, between branches or functional units located in different areas, by definition EDI is organisation-to-organisation.

<2> Computer-to-computer

EDI takes place between computers. Although trade automation is regarded as paperless trade procedures in the above, EDI was not devised just to eliminate paper, but to minimise the time and the data entry associated with paper-based practices. In existing paper-based business practices, much of one computer's business data output becomes a second computer's business data input. This means that the same information is being entered, in different processes, into both computers. EDI links the computers such that duplicate data entry is removed.

<3> Business documentation

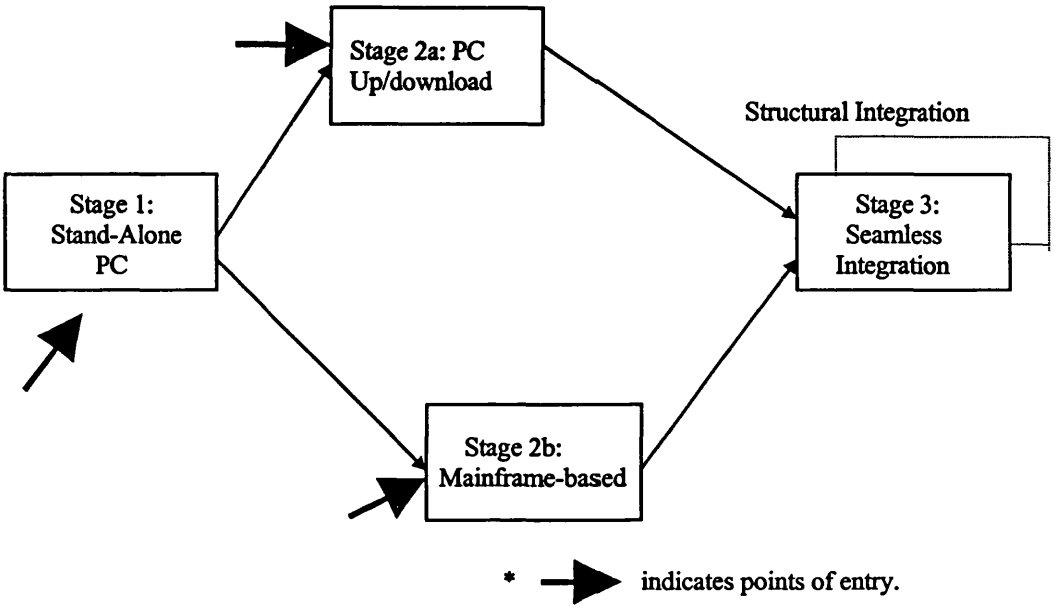
EDI is employed to improve the flow and management of business information. Any information on a business form of any kind is appropriate for EDI. EDI is currently being used for all of the most common business transactions such as purchase orders, invoices, quotes, bills of lading, receiving advice and so on.

<4> Standard, machine-processable format

EDI is computer-to-computer communication, rather than person-to-person communication. Therefore the data being exchanged must be understandable to the computers in the network. This means the data must be in some pre-established, structured format, thus allowing the data to be "read and understood" by the computers without human interpretation.

EDI develops through three stages of integration (Swatman and Swatman, 1992, pp. 198-199; Emmelhainz, 1993, pp. 121-125), which are depicted in Figure 4-2. Each stage implies how closely EDI is linked with actual business processes.

Figure 4-2. The stages of EDI integration (adapted from Figure 3, Swatman and Swatman, 1992)



<1> Stage 1: Stand-alone personal computer

In this stage, EDI is not integrated into any of the companies' internal processes. A personal computer with EDI software is used for translation and communication of EDI messages. Data needed to create an outgoing EDI message is manually input to a personal computer; software on the PC translates the data into the standard format and communicates the message. For an incoming EDI transaction, the message is received by the PC software, is printed out, and is then handled as if it had originally been received on paper. EDI in this stage simply saves the time spent for moving documents between the parties concerned.

<2> Stage 2: PC up/download or mainframe-based

The second stage may take two alternate paths. In the one path (2a), files created by the mainframe applications systems are downloaded to a personal computer which has the EDI translation and communication software. Files received through the EDI PC are uploaded to the mainframe. In the other path (2b), the EDI software is itself based on a mainframe, which further eliminates uploading/downloading.

The two paths are essentially the same stage of integration, since the physical location of the EDI translation/communication software is not important. In this stage, the application systems of the trading partners are linked, and

information generated by one company's computer is electronically transmitted to the computer of its trading partner. Although that information is also electronically entered into the trading partner's application system, the integration with internal information systems is not complete. The removal of the keying-in and printing-out of messages, though limited to some applications, leads to speeding up the process and making incoming messages more useful. No duplicate data entry leads also to fewer errors.

<3> Stage 3: Seamless integration

In this stage, EDI transactions and other functional applications such as purchasing, order entry, production scheduling, inventory management, accounts receivable/payable, shipping, etc. are seamlessly integrated. Nearly all of the claimed benefits of EDI are realised at this stage. The integration in this stage often accompanies fundamental changes in existing processes or elimination of the document for which the processes are needed. It may lead to structural integration. Therefore Emmelhainz designates the stage as 'process re-engineering' (1993, pp. 121-125). The three informants who are IS people in charge of the EDI project in each company under study have frequently mentioned 'business process reengineering' and claimed that the final goal of their EDI projects was to 're-engineer' the processes involved in trade-related administrative work in each company.

When trading companies in Korea get involved in trade automation, there are two options available depending on their size and capability. Because stand-alone EDI offers a way to very quickly and relatively cheaply meet the demands of a customer who requires EDI, small-and-medium-sized companies start with it and gradually proceed to the next stage. Most large trading companies start with the pilot of personal computer based systems for a short period of time, and then immediately move to the stage of mainframe-based systems (2b).

2. Trade automation in Korea

Trade automation in Korea started with the establishment of the Korea Trade Network (KTNET). It was founded in June 1992 to develop and provide

electronic data interchange (EDI) services which facilitate international trade transactions. KTNET is the provider's name as well as the name of the services which the company provides.

a. Reasons for trade automation

The trade automation project was promoted under the strong guidance of the government. The following domestic and international factors caused the government to lead the initiative (National Computerization Agency, 1995). Korea has shown extraordinary economic growth. This development was fired and has been maintained by an outward-looking export strategy. In 1994, the annual value of trade was recorded as 198.6 billion US dollars and Korea became the twelfth largest trading nation. The expansion of trade in Korea has reached the limit of capacity to deal with trade transactions manually. The number of customs clearances for import and export per year is continuously increasing by more than 12 percent to amount to over 4.5 million in 1994. A recent survey of import/export procedures shows that the completion of a typical order requires 35 visits to government offices, banks and other institutions, and entries of 50 to 150 documents with about 200 fields, of which, furthermore, around 20% are repeatedly entered. The increasing volume of trade and the enormous amount of the administrative work involved require the Korean economy, unless special action is taken, to spend increasingly more money to maintain it, which weakens the economy's competitiveness in international trade. An economy which is dependent for its success on foreign trade, accounting for 62% of GDP in 1994, could benefit from trade automation to enable continued growth in the increasingly competitive world market.

Abroad, trade automation is a world-wide trend. In most advanced countries and Korea's rival countries in international trade such as Singapore and Taiwan, trade automation is under construction or partly completed and put into use to sharpen their competitive edge in world trade. Furthermore, it is expected that the United States will ask all its trade partners to submit documents for customs clearance via EDI. In the Pacific Rim, EDI is becoming increasingly important to trade. At a 1991 Asia-Pacific Economic Co-operation (APEC)

meeting, the APEC ministers recognised the "vital role of telecommunications in promoting the freer flow of information, goods, and services." EDI activity in trade is taking place in most of the countries in the region such as Japan, Singapore, Hong Kong, Australia, New Zealand and so on. Taken into consideration the two factors, domestic and international, the introduction of EDI for international trade is considered to be essential to increase the country's competitiveness.

b. The development of KTNET

The development of the trade automation project in Korea consists of three stages (National Computerization Agency, 1995). In the first stage from July 1987 to the end of 1993, a period to establish the foundation, "The Act on Promotion of Trade Business Automation" was passed. In this period, standard electronic documents were developed and pilot projects were conducted. Forty-one organisations (8 banks, 6 shipping companies, 3 insurance companies, 6 customs brokers and 18 trading companies) participated in the pilot projects. They tested the stability and practicality of the new system with 29 electronic documents of basic trade affairs.

The second stage from January 1994 when basic operations in trade, exchange and customs clearance started, is the stage of expansion. In this stage, efforts were made to improve and expand user environments, which consisted of public sector users such as government offices, exchange banks and other trade-related institutions on the one hand, and trading companies on the other. In 1994, special focus was given to clearance systems of the Customs Office and exchange systems of banks. "The Basic Agreement on Interfacing Financial Network with Trade Automation Systems" was signed in June 1993 with the Korean Financial Telecommunication and Clearings (KFTC). From January 1994 it was made possible to transmit electronic documents between banks and trading companies. In customs clearances of the Customs Office in which the largest number of operations in trade are involved, the export clearance automation system started and provided services for export licence and export permit information retrieval in December 1994. It is intended that the whole procedures of customs clearances will be processed by EDI from the latter part of 1996. Some industry associations

such as the Korea Textile Association and Korea Tire Manufacturing Association, which are responsible for export/import recommendations and licences, have completed the implementation of EDI systems and started transmitting documents via EDI. The scope covered by KTNET is expected to increasingly expand.

In the third stage which had not started as of the completion of fieldwork in January 1996, efforts will be made to expand to cover whole operations in exchange and customs clearance sectors, the implementation of the nation-wide system and the connection to international trade networks. Table 4-2 shows a brief chronicle of the development.

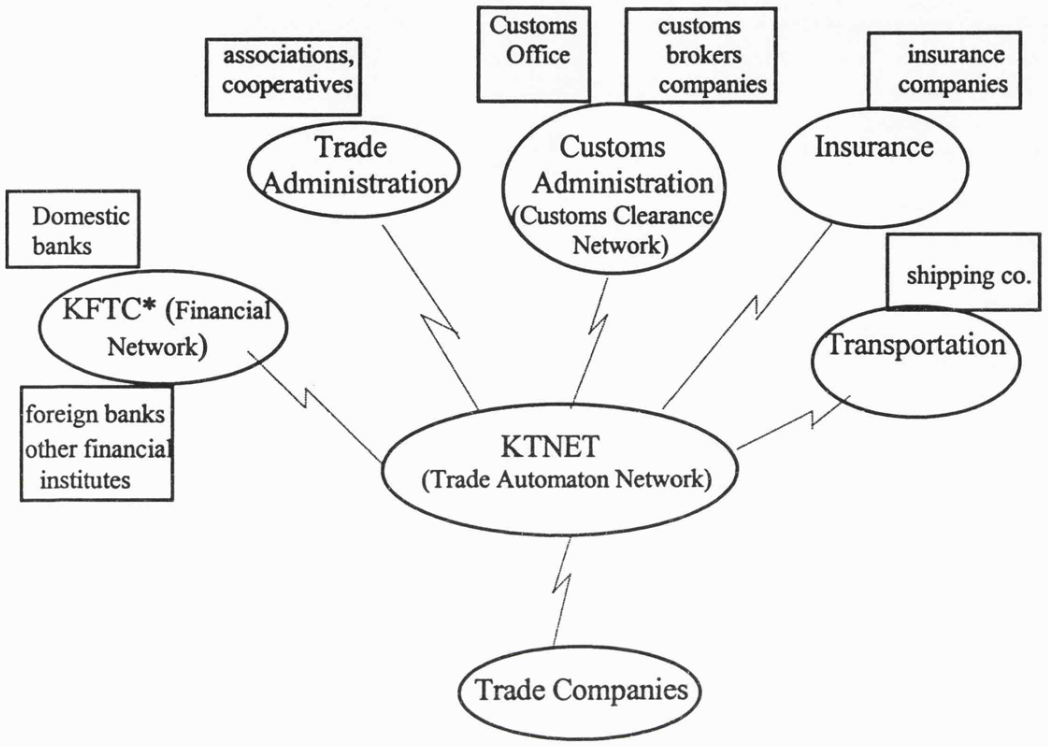
Table 4-2. The chronicle of trade automation in Korea

July 1987	Reports on trade automation systems submitted to 'Executive Convention for National Computerisation'
October 1989	"General Trade Automation Basic Plan" finalised by the Ministry of Trade and Industry
April 1990	'General Trade Automation Project Planning Team' organised under the sponsorship of the Korea Foreign Trade Association
December 1991	A special law "The Act on Promotion of Trade Business Automation" enacted
June 1992	Korea Trade Network founded
August 1992	Pilot user systems installed
November 1992	"The Basic Agreement on the Construction and Operation of an EDI-type Customs Clearance Automation System" signed; Pilot projects initiated (41 pilot organisations participated)
March 1993	Trade automation services declared as a key project of "The New Five Year Economic Plan"
June 1993	"The Basic Agreement on Interfacing Financial Network with Trade Automation Systems" signed with the Korea Financial Telecommunication and Clearings
January 1994	Services in trade/foreign exchange documentation (L/C and Licences for export and import) started
December 1994	Customs Clearance services started

3. The structure of KTNET

The trade automation network consists of six categories which altogether form the whole structure of international trade (Figure 4-3). The six categories of trade automation (EDI services) are trading administration, foreign exchange and finance, customs clearance/duties, transportation, insurance and trading companies (KTNET, 1995). If the system is completed and diffused to some extent, it will cover a great number of organisations involved in international trade (Table 4-3), and most practices in international trade will be affected (Table 4-4).

Figure 4-3. The structure of KTNET interfaces



* Korea Financial Telecommunication and Clearings

Table 4-3. The number of organisations in trade business
(adapted from Table 2-2-51 in National Computerization Agency, 1995)

(as of the end of 1994)

Category	Type	No.	Remarks
Trading companies		about 53,000	
Trade administration	import/export recommendation institutions	93	
Exchange banks	domestic banks	33 (2,734)	(no. of branches)
	foreign banks	52 (73)	"
	other financial institutions	15 (25)	"
Customs	customs offices	41	including branches
	agents	344	"
Transportation		670	
Insurance		12	

Table 4-4. Five categories of international trade and documents covered by KTNET
(KTNET, 1995)

Category	Application ranges	Message titles
Trading & administration	• Export/import licences	-Application for export/import licence -Export/import licence
	• Approval of revisions of export/import licences	-Application for approval for revisions to export/import licence -Approval for revisions to export/import licence
	• Approval of validity extensions for export/import licences	-Application for validity extension for export/import licence -Approval of validity extension for export/import licence
	• Import licences for material purchases leading to future foreign currency earnings	-Commercial invoice; packing list -Application for import licence for material purchases leading to future foreign currency earnings -Import licence for material purchases leading to future foreign currency earnings
	• Export/import recommendations • Import recommendations for material purchases leading to future foreign currency earnings • Recommendations for revisions to export/import licences	-Export recommendation -Import recommendation -Recommendation for licence to import material purchases leading to future foreign currency earnings -Recommendation for approval for revisions to export/import licence
Foreign exchange & finance	• L/C opening • L/C advice • L/C amendment	-Application for documentary credit -Documentary credit opening -Application for documentary credit amendment -Documentary credit amendment -Export L/C advice -Export L/C advance notice -Export L/C amendment advice -Application for local L/C -Application for local L/C amendment -Local L/C advice
	• Local L/C opening • Local L/C advice • Local L/C amendment	-Local L/C amendment advice -Payment instructions -Payment receipt advice

	• Funds transfer related with trade affairs	-Payment advice
Customs clearance & duties	• Export/import declaration • Export/import licence	-Export/import declaration -Export/import permit
Transportation	• Shipping request	-Shipping request -Reply to shipping request -Notice of bills of lading issued -Notice of cargo arrival -Reply to notice of cargo arrival -Bay-plan
Insurance	• Cargo insurance subscription • Notice of cargo insurance policy issued	-Application for cargo insurance -Notice of issuance of cargo insurance policy

4. The current state of KTNET

The number of messages by document transmitted via KTNET and the number of users are shown in Table 4-5. The total number of user organisations as of December 1995 is 1,575 in which all exchange banks (calculated by headquarters, not by branch), customs offices, most of trade-related organisations are included. The number is very small compared with the total number of organisations involved in trade business, which are potential subscribers of KTNET depicted in Table 4-3. It reveals that the subscription of trading companies, which should be the main beneficiaries of KTNET, is quite low. Despite the anticipation from the government and the service provider, KTNET, the diffusion of the system is slower than expected. Although the subscription rate of trading companies is minimal, the rate of documents transmitted via KTNET among the total of documents processed per day in international trade is not insignificant. About one fifth of export licences, for example, are processed via KTNET (Table 4-6), from which we can infer that the main users of KTNET are large trading companies.[1] There are large trading companies in Korea called 'general trading companies' which are the by-product of the Korea's export-driven economic development policy. They normally do not manufacture themselves, but specialise only in international trade for manufacturers which do not have the experience and capacity to market their products in international markets. General trading companies in Korea are playing an active role in the development of trade automation, and they run a "General Trading Companies' Meeting for EDI". Although the number of trading companies involved in KTNET is quite small, most of the large trading companies are affected by the system. Judging from Singapore's case, which is a model for KTNET, the diffusion rate is expected to increase rapidly. In Singapore by 1991, over 80 percent of the country's import-export trade documentation was handled by the system (Emmelhainz, 1993, p. 236)

[1] Small companies have a small number of transactions. Therefore they generally have no need to automate transactions. In addition, they cannot afford the cost of installing the system.

Table 4-5. The number of messages transmitted via KTNET and the number of users

(from a KTNET internal document)

	E/L	I/L	L/C Advice	L/C Opening	Local L/C	Negotia-tion Bills	Payment Advice	No. of Users (accumu-lated)
3/4 94*	8,984	3,278	2,782	2,493	-	-	-	590
4/4 94	19,615	7,606	6,285	5,274	-	-	-	1165
1/4 95	31,676	13,481	7,179	8,134	6,272	-	-	1280
2/4 95	23,680	12,121	9,124	7,793	24,371	866	128	1418
3/4 95	39,997	26,544	13,635	18,610	50,883	27,909	202,394	1511
4/4 95	37,285	39,818	10,653	27,996	46,095	80,395	358,125	1575

* July 1994 is not included in this row.

Table 4-6. The rate of usage by document

(from a KTNET internal document)

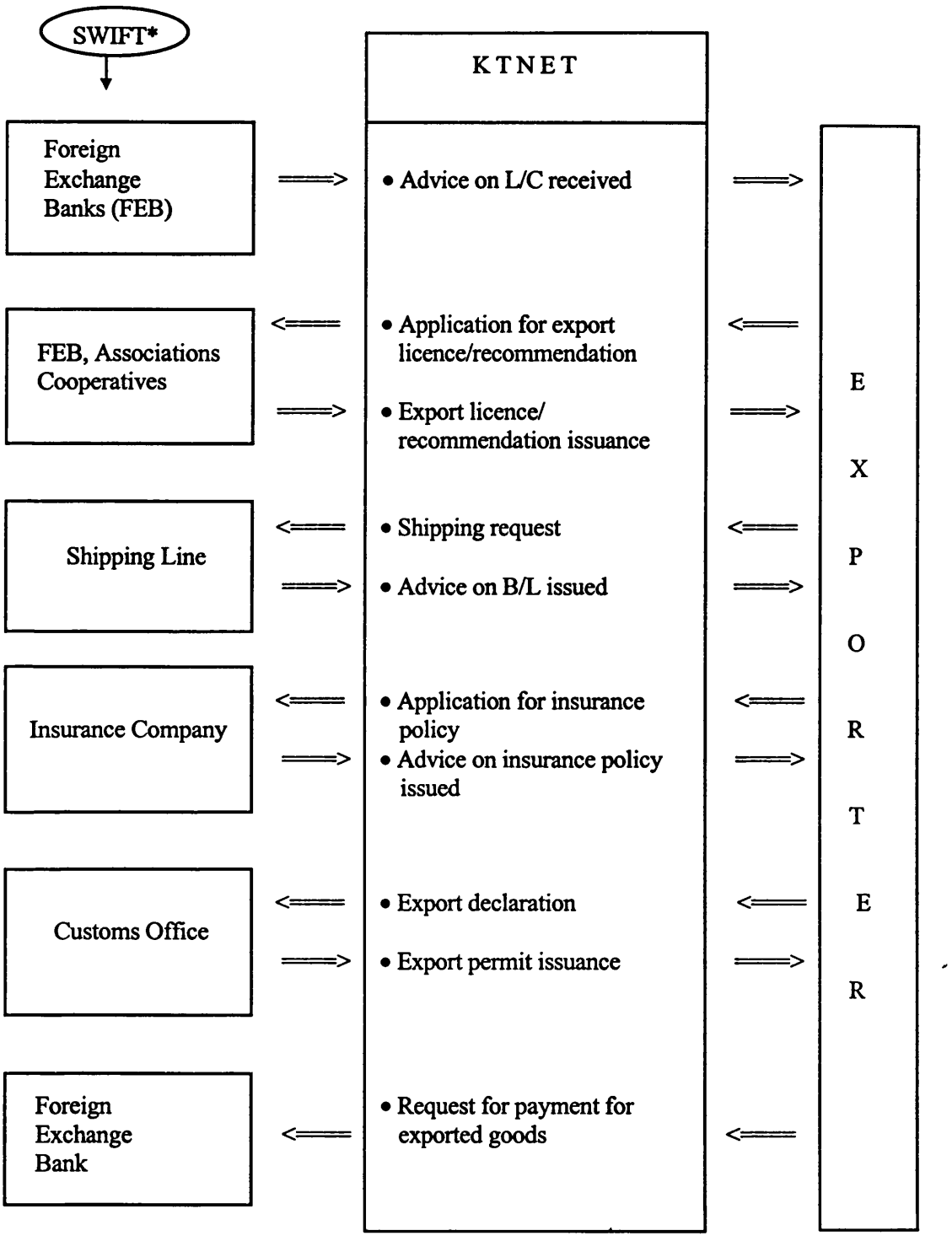
Documents	the total number of transactions*	the number of KTNET transactions**	the rate of usage***
Export Licence	1,666	323	19%
Import Licence	2,666	308	11%
L/C Advice	1,666	208	12%
L/C Opening	3,333	208	6%
Local L/C	4,998	558	11%
Negotiation Bills	46,666	969	2%
Payment Advice	56,666	800	1%
Cargo Insurance Notice	4,324	50	1%

* The total number of transactions is the average of daily transactions taking place in international trade in Korea.
** The number of KTNET transactions is the average of daily transactions processed via KTNET as of 27 December 1995.
*** (the rate of usage) = (the number of KTNET transactions) ÷ (the total number of transactions)

5. Export and import procedures via KTNET

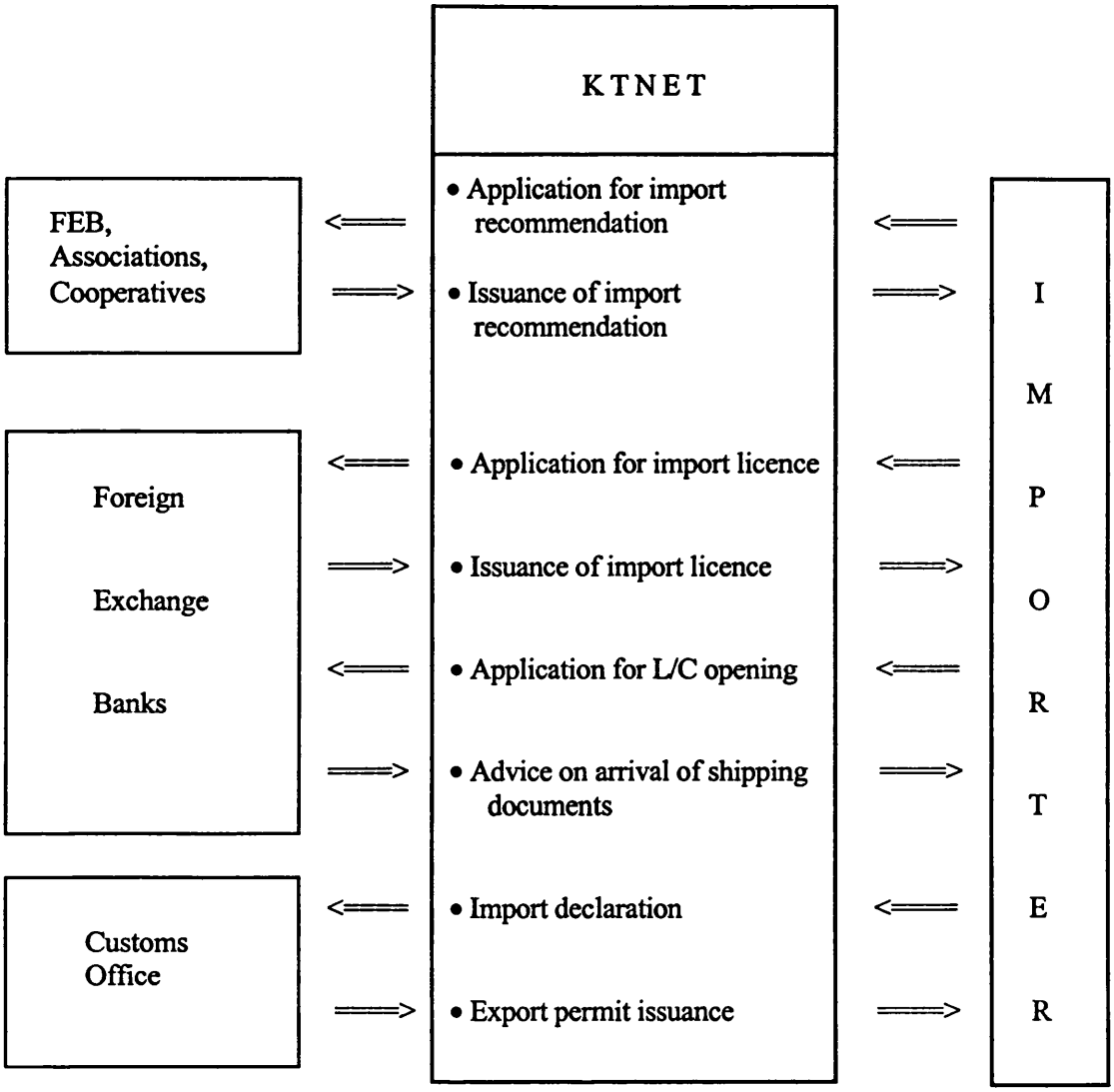
Figures 4-4 and 4-5 show the procedures of export and import through KTNET. This research focuses on the export side. The import side was excluded from the analysis because much of it is duplicate of the export side in the opposite way. The same analysis can be applied to the investigation of the import side.

Figure 4-4. The procedure for export via KTNET (KTNET, 1995, p. 6)



* SWIFT: Society for Worldwide Interbank Financial Telecommunication

Figure 4-5. The procedure for import via KTNET (KTNET, 1995, p. 7)



C. Organisational Backgrounds

1. The Daewoo Corporation

a. Company profile

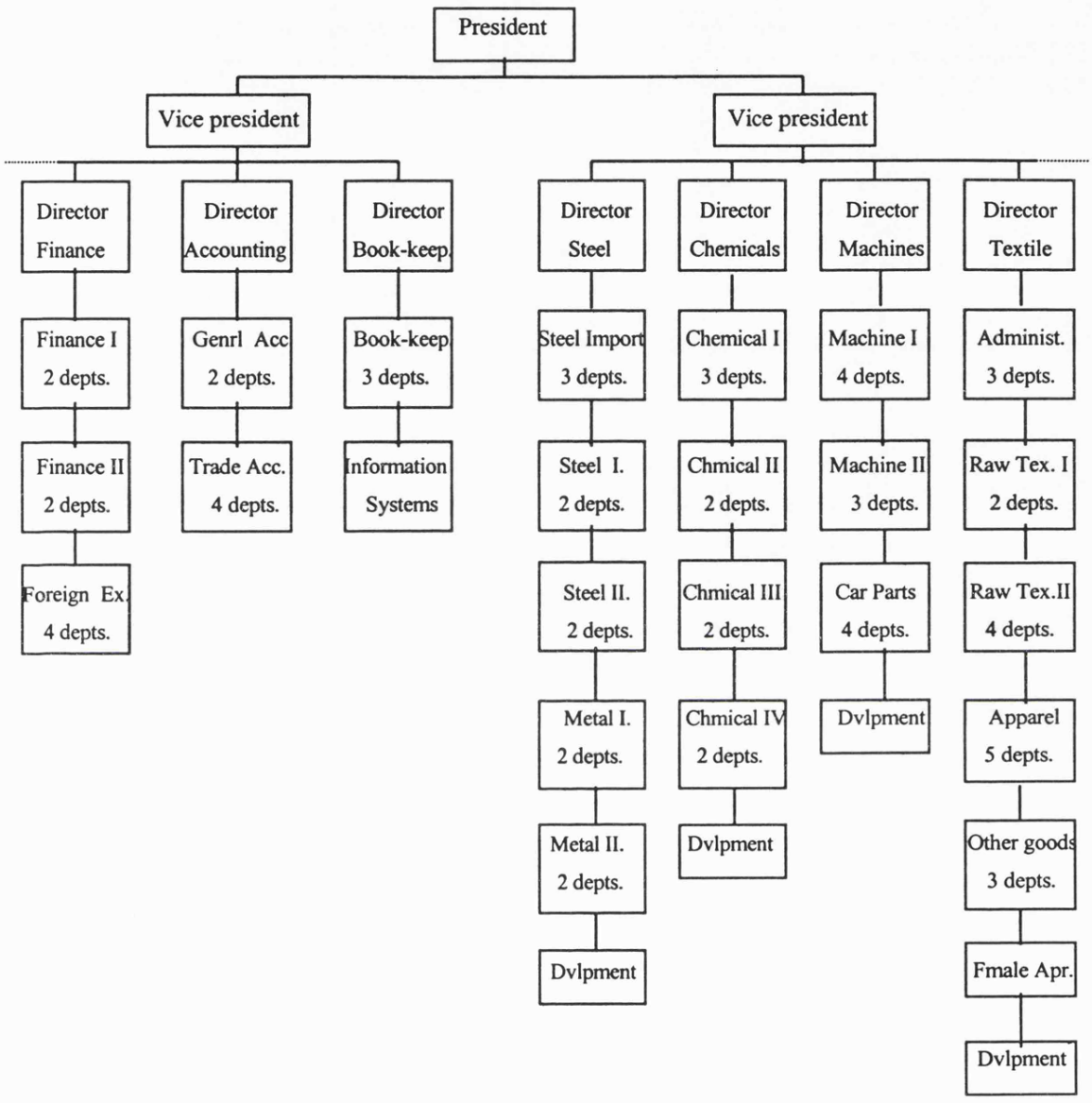
The Daewoo Corporation is one of the largest general trading companies in Korea. As its name implies, it belongs to the Daewoo Group (a 'chaebol', or business conglomerate) which has 22 member companies. The corporation is the parent and flagship company of the Daewoo Group. It consists of two divisions, general trading and construction, and performs all these functions for the Group. Because this research deals with the EDI network in trade business, the construction division is excluded from the discussion. The sales in 1995 were valued at US$ 15,880 million, of which US$ 10,660 million came from exports (Daewoo, 1996). The number of employees in the trading division is around 2,300. The company has a worldwide network that includes over 100 branch offices and trade subsidiaries as well as over 70 foreign investment companies.

b. Organisation of the company

As the term general trading company implies, the company deals in a great variety of products. It deals in over 3,500 products with 165 nations. The company does not manufacture the products it trades. Its main business is to connect sellers (exporters) at home to buyers (importers) abroad and vice versa. The company is divided into two parts, administrative and business. The former contains the functions of planning, personnel, general management, accounting and finance as in a typical company. The latter is organised according to the goods in which each department specialises. There are 12 business divisions by goods such as steel and metal, non-steel, chemicals, machines, textile and light industry, and so on. Figure 4-6 shows part of the company's organisational chart, which is simplified and in which the departments involved in this thesis are emphasised for their actual positions in the company. In Figure 4-6, the information systems sub-division belongs to the book-keeping division. The company does not have a director in charge of information systems and the IS part takes a low position in the company. The reason is that workers in the information systems sub-division do not belong to the Daewoo Corporation. They are seconded from Daewoo Information Systems

Co. Ltd. which is a separate company responsible for all the IS projects in the Daewoo Group. Workers in the IS sub-division work at Daewoo Corporation, but they officially belong to Daewoo Information Systems. It is not a unique phenomenon of Daewoo. Many Korean 'chaebols' such as Samsung have established their own separate IS companies (Samsung Data Systems) which are to conduct all the IS related projects within their group.

Figure 4-6. The organisational chart of Daewoo (adapted from an internal document)



Each division has three or four sub-divisions, which in turn are divided into two or three departments which deal with a narrow range of items. For example, the department whose two workers (one male and one female) the author interviewed deals only with tyres and tubes. The department belongs to the sub-division dealing with a wider range of car parts, which in turn belongs to the Machines Division. Each division is partly independent in running business. It has its own administrative department which is responsible for planning, accounting and finance (international and domestic). In this system, the overall finance and accounting divisions have relatively small power over the business divisions. However, just before the fieldwork started, there was a change which allocated those functions back to the finance and accounting divisions. Through this change they now became bodies responsible for finance and accounting for all the business divisions. Under the new system, the foreign exchange sub-division in the finance division supports all the business departments' financial activities. The sub-division makes all the transactions with banks for all the business departments. Now workers in business departments do not have to go to banks. Only workers who are in the foreign exchange department deal with banks unless an unusual case occurs. Therefore the foreign exchange sub-division is the unit most significantly affected by the new EDI system. It has 53 workers and consists of four departments. Of the four departments, one has 17 workers and handles negotiation, which is one of the four main export procedures analysed in the research.

To describe working practices in business departments, we will take as an example the department for tyres and tubes mentioned above. The department consists of nine workers, 5 male, 4 female and one male manager. According to the worker who was interviewed, such an organisation is typical in the company. The division between male and female is significant in understanding working practices in the company. While all male workers are university graduates, most female workers are only high school graduates. Therefore the division of labour is formed by both gender and education. The company has a peculiar practice for organising workers in business departments. One female and one or two males make a team (called 'cchak' in Korean meaning 'a pair'), in which the female assists the male

worker(s). While male workers work on core business jobs, exchanging correspondences, negotiating, gathering information on their items and market situation, writing up documents, making quotations, making contracts, travelling on business and so on, female workers assist males' activities by sending faxes, making photocopies, making simple formated documents, running errands to banks and so forth. The EDI systems in the company affected mostly female workers rather than male workers[2]. Thus, most of the interviewees in the fieldwork were women. This department deals with an average of 150 orders per month with each male worker processing 30 orders a month. According to the worker interviewed, they all are busy all the time "beyond your (the interviewer) imagination", answering and replying to lots of faxes, telexes, phones, letters, requests, quotations to make a deal successfully, and afterwards, once the order is made, dealing with a great amount of administrative work involved in exporting goods.

c. Export procedures within the company

The followings are working procedures for exporting an item within the company.

<1> Once a contract is completed, an accepted order is entered into the internal information system.
<2> The cost is calculated.
<3> The Master L/C for the order is received from the administrative department of the textile division which brings in L/Cs from banks.
<4> The order and the Master L/C on the internal information system are matched.
<5> An export licence is obtained from banks or manufacturing associations depending on items.
<6> A manufacturer who is to produce the export goods is decided on.
<7> A request for the opening of Local L/C is made to the foreign exchange department, which in turn applies for it to banks.
<8> A shipping request is made to shipping companies.
<9> The invoice and the packing list are prepared.

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2 See footnote 6 in Chapter 3.

<10> A request for export clearance is made to the Logistics Administration Sub-division, which in turn takes responsibility for export clearance in ports. In this stage, export permit is issued from the Customs Office, and bill of lading from shipping companies.

<11> All the costs involved in previous steps are calculated.

<12> To prepare for negotiation, a summary of all the documents and costs involved is made, and a set of documents is made to be delivered to the foreign exchange department; they are the invoice, packing list, bill of lading, letter of credit and export permit as basics. In addition, documents that buyers
demand such as country of origin, GSP (generalised system of preference) form A, etc.

<13> A request for negotiation is made to the foreign exchange department, which in turn makes negotiations in banks

<14> When negotiations are completed, bills are transferred to Trade Accounting Sub-division, which completes the export process from the viewpoint of business departments.

We should note that the steps described above represent only half of the whole work involved in completing the export of one item. Until the sales contract is made, there are many faxes, letters, telex and phones exchanged among the company, manufacturers at home and importers abroad. Most of the work in that process belongs to the male clerical worker. Therefore we should not disregard that amount of work which KTNET cannot accommodate. Although KTNET decreases significantly the large amount of work related to administrative procedures within the company and between organisations, "the basic process of 'doing business' has not changed a lot", said a male worker in a business department.

d. KTNET in the company

Because of this heavy load of export business, the company has made much effort to increase the productivity of administrative work for trading. The company has played an active role in the development of the Trade Automation Project in Korea from the beginning. It was the first company which was

connected to KTNET when it started a pilot run for the system in March 1993. Since then, it has extended its connection along with the expansion of services provided by KTNET. Daewoo employs EDI systems in dealing with master L/C advice, export licences, import licences, local L/C application and export permission. The company developed the negotiation system in November 1995 in which the author was allowed to conduct interviews before and after the implementation. Daewoo is playing a leading role in the association of general trading companies for EDI.

The EDI system in Daewoo is mainframe-based, which corresponds to stage 2b, according to Swatman and Swatman (1992). It is not yet satisfactorily integrated into the internal management information systems. Accounting systems, for example, are separated from the EDI system, which means, in a temporal sense, they are running on a different cycle, as will be shown later.

Whenever a new system was developed and introduced, it was welcomed by end-users in business departments and administrative departments. For example, when an opportunity to participate in a development project for a new system was given, they were cooperative with a hope that the new system would reduce their workload. Such participatory practice, however, was not common. Staff in the information systems sub-division consulted, when necessary, one or two end-users in business departments to be affected by the new system to understand work procedures. Management was also enthusiastic about the EDI implementation with the expectation that it could increase the productivity of administrative work, and therefore reduce the workforce involved in administration.

2. Sunkyong Limited

a. Company profile

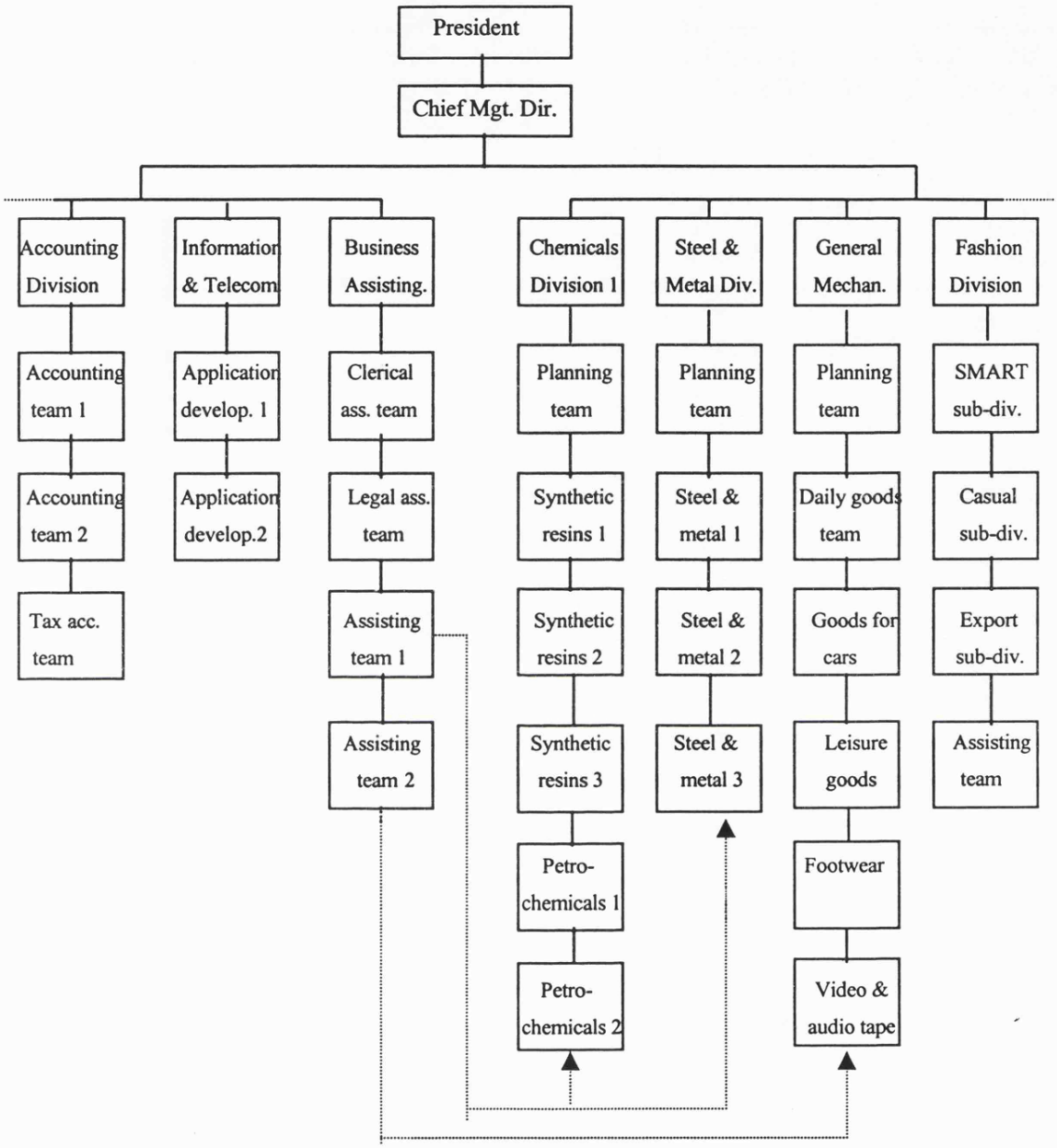
Sunkyong Limited is also one of the major general trading companies in Korea. The company is the founding company of the Sunkyong Group, one of the big five 'chaebols'. It currently trades with over 120 countries through more than 40 overseas branch offices, handling over 2,000 items ranging from textiles,

garments and construction material to chemicals, plants, electronic goods and other industrial products. Although the company's business areas include financing, natural resources development, domestic business and business R & D, trading is the most fundamental area of its business endeavours. The sales in 1995 is about US$ 5,169 million, and the company exported US$ 3,396 million in the same year. The number of employees is over 1,400.

b. Organisation of the company

The basic principle of organisation in Sunkyong Limited is the same with Daewoo's. The whole company is divided into two parts, administrative and business. The former consists of basic functions of management: strategic planning, personnel, general administration, accounting, finance, and so on. The latter is organised according to the goods in which each business division specialises. In Sunkyong, there are eleven business divisions; each division has several business teams which deal with a narrow range of goods. A business team is an equivalent of a business department in Daewoo. Figure 4-7 shows part of the organisational chart.

Figure 4-7. The organisational chart of Sunkyong



Each business division is more independent in running business than in Daewoo. This is revealed in the fact that each division is supported by one of assisting teams. They deal with accounting, financing (local L/C and negotiation) and other administrative functions (including export licence) which emerge in the course of each division's business operation. In a formal sense, the assisting teams do not belong to business divisions (Figure 4-7). They have their own upper unit, the Business Assisting Division. However each assisting team is supported by its matched business divisions in terms of budget. Assisting team 1 assists heavy industry divisions; team 2 has relationships with light industry goods divisions. Domestic business divisions such as the Fashion Division form an exception. Because they operate in the domestic market and therefore are different from other divisions in their activities, they have their own separate assisting teams.

As in Daewoo, the division of labour is formed by gender and education. Male university graduate workers perform business jobs (e.g. making decisions and negotiating) with their counterparts outside the company, domestic or abroad, in order to make a deal; female workers, many of whom are high-school graduate, assist male workers, doing simple tasks such as photocopying, word-processing, running errands to banks and so on. Female workers are most affected by the EDI systems for trade automation, so interviews in Sunkyong were made with female workers.

c. Export procedures within the company

Export procedures in the company are almost the same as Daewoo's except for the fact that each business division has its own assisting team. In Daewoo, the foreign exchange sub-division in the finance division takes all the administrative work generated by exports in business departments. Despite this difference, the basic mechanisms of export procedures in both companies are almost the same, and the steps for export described in the section on Daewoo are also applied to Sunkyong's working practices. In the next chapter, therefore, descriptions and analyses of working procedures for the four main export tasks in trading companies do not distinguish between Daewoo and Sunkyong. Differences between the two are specified only when they are significant.

d. KTNET in the company

The company began to use KTNET in August 1993 when master L/C advices of some business teams were transferred on a personal computer based system. Master L/C advice reception for the whole company and export licences for some departments were realised in March 1995. In May export licences were extended to the whole company, and local L/C started on the whole company base. In particular, the implementation of local L/C opening system increased the number of user departments and the number of orders processed through KTNET. Negotiation systems were not yet implemented when the fieldwork was conducted.

The introduction of KTNET was welcomed by workers in both business teams and assisting departments, although there is a delicate difference. Because the purpose of such a new technology from a viewpoint of the management is to raise the productivity of labour and remove redundant workers or unnecessary units, the new system has a tendency to reallocate work between organisational units. In Sunkyong, KTNET took the direction mainly from assisting departments to business teams. As a result, the workload of workers in business teams increased while the workload in assisting departments decreased. Workers interviewed in business teams complained about that, but they accepted the situation partly with the recognition that the trend to remove assisting departments is inevitable for the interests of the company as a whole, and partly with a general expectation that in the long term the situation will improve, making their working condition better by use of the new technology. Workers in assisting departments were neutral about the change, which means that they expected neither better nor worse. For them, good and bad things are mixed. In the short term, although some of their work is being removed, other new duties are being imposed immediately. In the longer term, even when their department disappears, Korean employment practices guarantee that they will be relocated somewhere else in the company. Although most of the business teams were affected by the new system, the assisting departments, apart from their workers' attitude to the new system, have undergone the most significant change. The analysis in this research is focused on one of these departments. The EDI system in Sunkyong is, like Daewoo, based on a mainframe.

3. The Korea Exchange Bank

a. Company profile

The Korea Exchange Bank was established in 1967 as a state-owned bank to specialise in foreign exchange, trade financing and related services. As the economic growth of Korea accelerated, KEB expanded its business beyond the original scope, and has become a full-service commercial bank with an extensive network both at home and abroad. Since its privatisation in 1989, the bank has become the largest international commercial bank in Korea and offers a wide range of retail, wholesale, investment management consultant and securities services through its branches and subsidiary network.

As of 1994, the bank maintains over 7800 employees at 314 branches across the country. Overseas it provides services such as corporate banking, investment banking, trade financing and consumer banking through a network of 51 offices with about 900 employees in 20 countries.

b. Organisation of branches

For KEB, the organisation of a branch, instead of the organisational chart of the whole company, is described. The nature of jobs which bank workers perform in the course of their normal operation is substantially different between headquarters and branches. While work in headquarters is concerned with managing and controlling branches, work in branches is more customer-oriented. Because KTNET is a system to facilitate trade-related tasks in branches, for this research it is appropriate to focus on work practices in branches. Furthermore, although KEB has over 300 branches across the country, only a few of them are significantly affected by KTNET. This is due to two factors. First, a typical branch consists of two lines: the one for savings and the other for loans. In the majority of ordinary branches of medium-and-small size, trade-related tasks are allocated to the loan line. Because they deal with a small number of companies which have foreign trading business in their local areas, they do not need a separate line for the trade-related job. For these branches, export related business is quite small, and the potential effect of KTNET on them is minimal, even if some of their customer companies are connected to KTNET. Second, for some large branches which have

a relatively large number of customer companies, many of their customer companies cannot afford the new system because both of the small quantity of export orders they normally deal with on the one hand, and of the cost required to install the system. These branches continue to use both old and new ways of export procedures at this early stage of KTNET because small companies perform their business in a paper-based way. Therefore the impact of KTNET is limited.

For the above two reasons, only a handful of branches which are located near big general trading companies with a large volume of export business could be substantially affected by KTNET. The branches which the author visited during the fieldwork are sited near the Daewoo and Sunkyong buildings. They have a large number of transactions with the two companies. They have a separate section for trade related business, which is located upstairs and isolated from the bustle of downstairs crowded by individual customers with ordinary business. Furthermore, they have smaller separate sub-sections committed only to Daewoo and Sunkyong. These sub-sections are the parts which are significantly affected by KTNET. The typical division of labour by gender and education which was presented already in Daewoo and Sunkyong is also found. Female high school graduates sitting in a row behind a counter fill the bottom of the sections and the whole branch receiving customers and performing routine activities. They are under control of superiors who are mainly male university graduates and who sit just behind them. Even in these large branches, both the procedures before and after KTNET are used, which gave an opportunity for this author to investigate and compare both ways on the same site.

c. KTNET in the bank

As a bank specialising in foreign exchange and trade finance, KEB has played a leading role in the development of the trade automation project in Korea. It started the services of export licences, import licences, import L/C opening and amendment, and export L/C advice in January 1994. Local L/C advice and amendment were added in February 1995, and negotiations in May 1995. As of May 1995, 194 trading companies transact documents with 94 branches through KTNET. This figure of user companies is much lower than expected. KTNET is making slow progress even in KEB which is the leading organisation in the project

and has the largest number of customer companies. This is due, as already mentioned above, to the fact that small and medium companies cannot afford to or do not need to pay the cost required to install the system for their relatively small quantity of transactions.

In the whole configuration of KTNET, banks lie in a different position from trading companies. While trading companies are customers to be served, banks are in a position to serve them. Although the service provider is the KTNET company which provides the network service in a formal sense, from the viewpoint of trading companies banks are expected to provide service for them. Therefore KEB is trying to expand the use of KTNET among trading companies through a variety of marketing and support activities.

Chapter 5
Temporal Dimensions and Changes in Work Practice

A. Introduction

This chapter describes in detail changes in procedures of documentary work for export. Those changes were initiated by the introduction of KTNET in trading companies and banks. The way they are described is to compare procedures before and after the new system. More emphasis is given to procedures in trading companies, which are the main beneficiaries of KTNET. The work procedures in trading companies have been more dramatically affected than those in banks. As explained in the section on the Korea Exchange Bank in the previous chapter, banks transact with a great number of companies, small and large, some of which cannot afford the new technology. Therefore in banks, both the old and new ways of working are being conducted. This was a two edged sword for the author because it enables him to observe both ways of doing business, but it often makes it difficult to differentiate the two in the context of real working environments.

It is necessary to clarify the nature of descriptions following this introduction. Descriptions of procedures in trading companies are based upon a set of various sources. For descriptions of the previous procedures, the memory of interviewees was the main source. This was supplemented by internal documents. For descriptions of the present procedures, observations by the researcher were available. The main body of description, however, is based on interviews and internal documents. The description of the procedures of negotiation forms an exception. By the time the author began to contact Daewoo, the project for the EDI Negotiation System was being started. The author was invited to participate in the project and was able to have the opportunity to observe both before- and after-procedures. In banks, descriptions are based upon interviews first with an IS person and then with clerical workers who use the system.

This introduction presents a general picture of export procedures which are being performed in trading companies. Then the following sections will provide

detailed descriptions of each task respectively, comparing before- and after-procedures. The descriptions in each section are followed by examinations on changes in the six dimensions of temporal order described in Chapter 3.

1. The procedure of export

The work which this research deals with begins substantially with the completion of an export contract. As mentioned in the previous chapter, much work should be done before a contract is made. Once an order is placed and confirmed, a female worker in a business department, whose job is to assist, enters the order into the internal information system which gives a file identification number to each order. Then a male worker in a business department, whose job is business-oriented, calculates the cost which will occur in following-up the order. Sometime later the master letter of credit for the order arrives in the bank which is designated as the advising bank. The bank delivers the master L/C either to the company electronically, or to the appropriate branch through the internal mail. In the latter, the branch informs the company of its arrival, and the company sends its worker to fetch it. Whether it is delivered electronically or via the internal mail, business departments (teams) do not receive their master L/Cs directly from the banks. The foreign exchange department in Daewoo and the assisting teams of the business assisting division in Sunkyong collect them at appropriate bank branches or receive them electronically. The receiving departments classify and distribute the master L/Cs to appropriate business departments (or teams). Workers in business departments match the master L/C delivered with an appropriate order on the internal information systems.

Next, the business department needs an export licence from a transactional bank or an appropriate manufacturing association depending on items. The female worker prepares a series of documents to apply for the export licence. When they are ready, she delivers them to the department responsible for the application or transmits them directly to the appropriate institution via EDI. Meanwhile, the male worker decides from which manufacturer he will order the goods to be exported. Once the deal is done, the female worker prepares for the application of a local L/C, setting a series of documents. Then she makes a request for opening the local

L/C to the foreign exchange department, which in turn checks to make sure that all the necessary documents are in order, and takes them in person to banks (or transmits application messages via EDI).

The business departments make a shipping request to shipping companies and prepare the invoice and the packing list for the next step. Then a request for export clearance is made to the Logistics Administration Department, which in turn takes responsibility for export clearance at ports. In this step, the export permit for the item is issued from the Customs Office, and a bill of lading arrives from shipping companies. Now the male worker in business teams calculates all the costs which have occurred in the previous steps.

Then the female worker prepares for negotiation, making a summary of all the documents and costs involved and setting documents to be delivered to the foreign exchange department; documents include invoice, packing list, bill of lading, letter of credit, export permit and so on. When they are ready, she makes a request for negotiation to the foreign exchange department, which in turn negotiates with banks. The processes within the foreign exchange department will be described in detail later in this chapter. When negotiations are completed, bills are transferred to the Trade Accounting Sub-division, where at last the export process finishes.

In the following sections, four major steps for export in which EDI technology is employed will be described respectively: the advice of master L/C, the application of export licence, the application of local L/C and the negotiation. In each section, before-EDI procedures in trading companies are first examined, followed by after-EDI procedures. Then before- and after-EDI procedures in banks are described. For the export permit which is issued by the Customs Office, EDI was being employed during the fieldwork in Daewoo. It is not included in this research because it is not from banks, but from the Customs Office. As mentioned earlier, this research limits its scope to the connection between trading companies and banks.

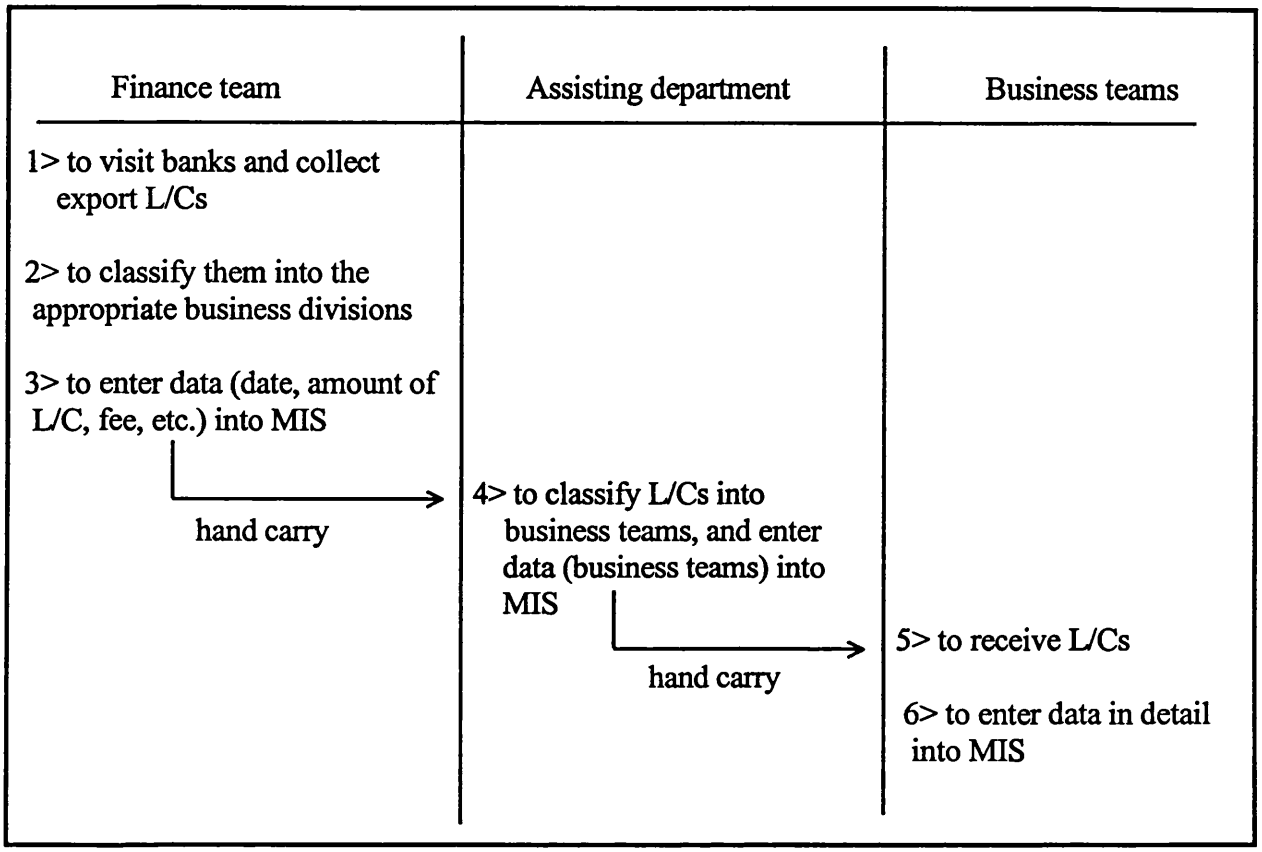
B. Export Letters of Credit Advice

Once the sales contract is made, the importer applies for a letter of credit and forwards it to the issuing bank, which in turn forwards it to the advising bank in the exporter's country, in this thesis, in Korea (see Chapter 4. A. 2. The letter-of-credit cycle). The advising bank relays the letter of credit to the exporter. This section deals with this stage. It is the stage 4 in Figure 4-1.

1. Procedures in trading companies

a. Before KTNET

Figure 5-1. Previous procedures for export L/C advice before KTNET in trading companies



Financial departments typically do much business with banks. Therefore, they make many visits to these banks. In Sunkyong, clerks in the finance team visit banks and collect export L/Cs, which they classify by the business division to which each order belongs. Then they enter data such as date, amount of L/C, fee, etc. into the internal MIS. After that, the L/Cs are transferred to assisting teams. Here the L/Cs are classified again and delivered into appropriate business teams, where clerks enter data in detail into the internal MIS. It usually took a week for an export L/C to finish its journey from its arrival in banks to its landing in the appropriate business teams. Suppose a L/C arrives in the bank on the first day of the month, it goes to the financial team on the second, to the assisting team on the fourth, and finally reaches the appropriate business team on the 7th or 8th.

In Daewoo, the procedures are the same with those in Sunkyong. Instead of the finance team, however, the administrative department of the textile division takes the responsibility for collecting all the L/Cs from banks and classifying them. Separate assisting departments do not exist in business divisions.

b. After KTNET

Figure 5-2. Current procedures for export L/C advice after KTNET in trading companies

1> (workers in charge in each business division) to check at a terminal whether new export L/Cs have arrived which are transmitted electronically from banks

2> to print them out

3> to classify them into business teams and deliver them

4> (workers in business teams) to enter data into the internal MIS

Under the new system, the finance team and the assisting teams are excluded from the process, and each business division deals with its own export L/Cs which are transmitted directly via EDI from banks. In Sunkyong now it takes one or two days for an export L/C to be delivered to the appropriate business team from the bank.

A clerk of the finance team used to visit the bank under his/her (usually her) charge once a day, typically before noon, to collect export L/Cs. In the new EDI system, instead of the finance team, a clerk in charge of export L/Cs in each business division can check at her terminal whether export L/Cs for her division have arrived whenever necessary. If she finds L/Cs waiting for collection on the EDI network, she prints them out and classifies by business team and delivers them.

2. Procedures in banks

a. Before KTNET

Figure 5-3. Previous procedures for export L/C advice before KTNET in banks

Foreign exchange division at the headquarters	Branches
Export L/C advices coming via SWIFT	
1> to select beneficiaries - to work out statistics for the Central Bank	
2> to print out texts	
3> to make two sets of L/Cs with coverings - to attach texts to coverings	
4> to get signed by the supervisor	
5> to make a list for delivery to branches, and to send faxes to customers via fax gateway	
6> to deliver L/Cs to branches	6'> branches in Seoul: by person, branch clerks despatched to headquarters twice a day to collect their branches' L/Cs; other regional branches: by internal mail
	7> to hand them over to customers - to collect fees

Company names on the texts transmitted through SWIFT do not completely coincide letter by letter with names on the list of customer companies. Therefore both should be checked and matched by a clerk in charge. Because export L/Cs are used to predict the next year's business performance by the Korean Central Bank, banks should provide statistics for the Central Bank. Then the clerk prints out texts, makes a cover page for each L/C, and attaches it to the text printed out. Two sets of export L/Cs are made: the original incoming advice called 'master copy', and a

photocopy marked 'certified true copy'. Then the supervisor examines the correctness of the documents and signs on it. In the meanwhile, the clerk prepares a delivery list, classifies documents into appropriate branches, and informs customer companies of the arrival of their export L/Cs via fax gateway. Branches in Seoul send their clerks to the headquarters twice a day to fetch their mail including their L/Cs. Export L/Cs for regional branches outside Seoul are sent by the bank's internal mail. In branches, the documents are handed over to the customer companies when their workers visit.

b. After KTNET

Figure 5-4 shows the route through which the EDI messages of export L/C go.

① The host computer receives export L/C advice from SWIFT (Society for Worldwide Interbank Financial Telecommunication).

② The system forwards the original L/Cs to recipient companies via KFTC (Korea Financial Telecommunication and Clearings) and KTNET. At the same time the host system makes a notice to the appropriate branches for the purpose of fee collection.

③ Data are available in branches for administrative purposes.

Figure 5-4. The flow of EDI messages of export L/C advice

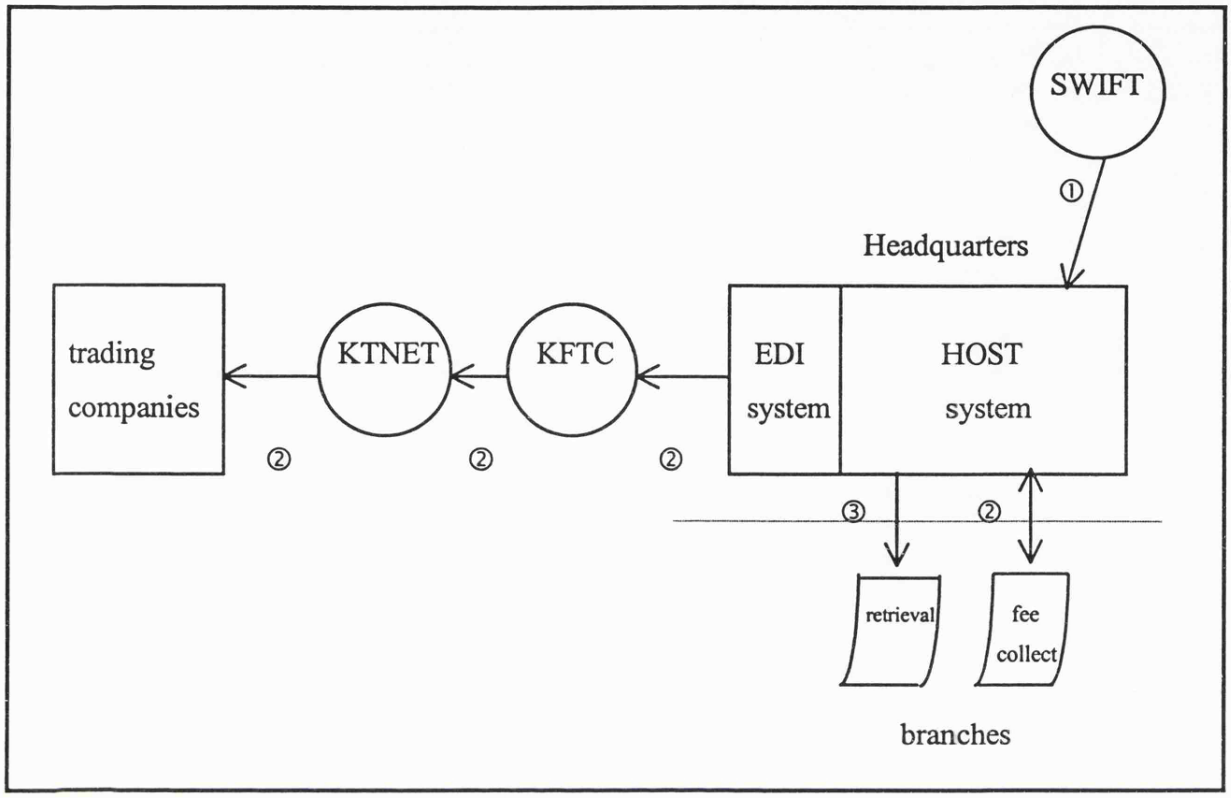
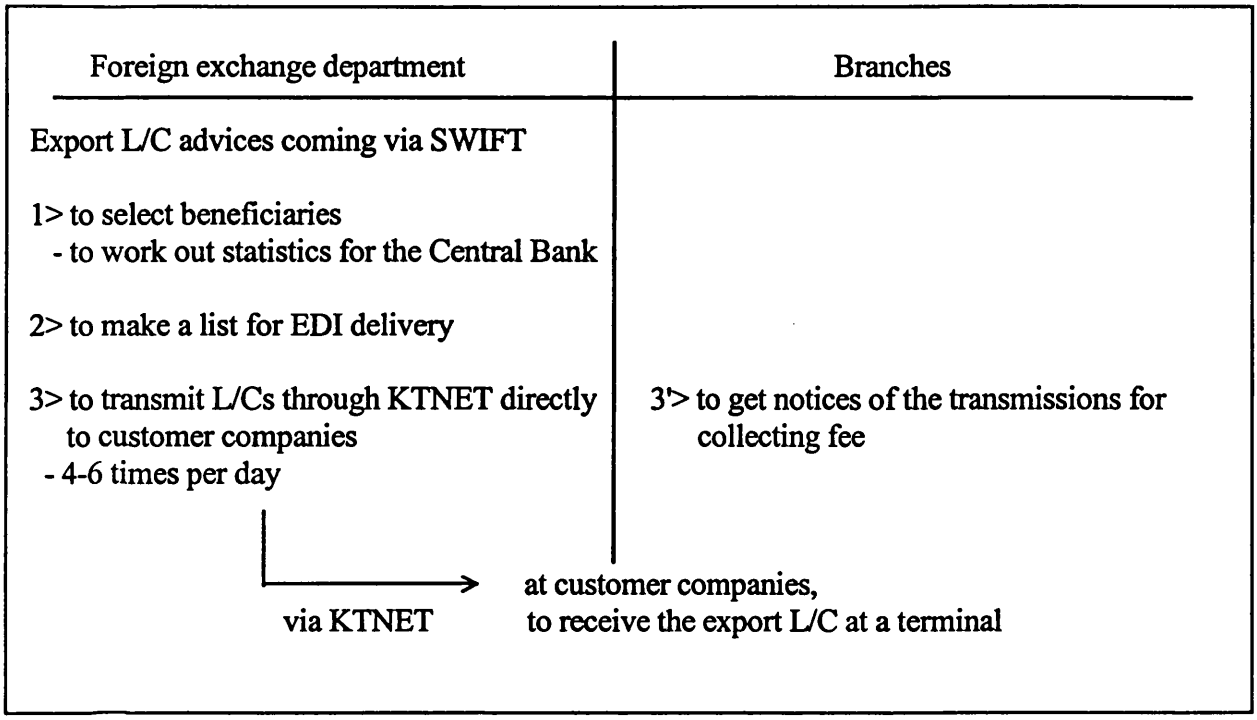


Figure 5-5 describes work procedures via KTNET for export L/C advice in the Foreign Exchange Division in the headquarters and branches. In after-EDI procedures, banks do not have to make paper copies of export L/Cs, which consequently eliminates printing out texts, making cover sheets and combining both of them. Now they send L/Cs directly to the appropriate companies via KTNET four to six times per day. In the new work process based on the EDI system, branches are excluded from the main flow of the procedures. They are only informed of the transmission of L/Cs to their own customers companies for the purpose of fee collection. However not all the companies are accessed through KTNET. For those companies, banks send L/Cs through branches in the old way described in Figure 5-3. It makes work procedures complex in banks, which explains bank workers' relatively less optimism and more hesitant attitude about KTNET than those of workers in trading companies.

Figure 5-5. Current procedures for export L/C advice after KTNET in banks



3. Changes in the six dimensions of temporal order

We have so far described changes in work procedures of export L/C advice between before and after KTNET. In this section, we examine how those shifts in work procedures affect the six dimensions of temporal order described in Chapter 3.

a. Duration

Duration refers to the amount of time spent to complete a task or an activity. A task is composed of several unit tasks. For example, as seen above, the advice of export letters of credit consisted of 6 unit tasks or steps before KTNET on the side of trading companies. Therefore, to be exact, duration is the sum of time spent to finish each unit task plus time for moving between steps. The exact measurement of time in work is the main job of time (and motion) studies in the Taylorist tradition. Such measurement was not attempted in this research. In fact, it was almost impossible to measure them and compare between before and after KTNET. Most of the 'before' work procedures were reconstructed from documents and workers' memories. It was impossible to measure exactly the duration of each unit task. Even in the existing work procedures it was difficult to measure a standard (or average) time consumed to process a specific unit task for one order because more work is done in batch rather than dealt with one by one. Furthermore unit

tasks (or steps) themselves change in number, order and content so that it is inappropriate to compare their duration between before and after KTNET. In examining 'duration' in this research, therefore, only some major steps are included. Another justification is that changes in duration are partly reflected in the dimension of cycle. Duration is obviously one of the most elementary aspects of temporality as represented in the phrases such as 'time-saving' and 'speed-up', but is not that much significant in the research.

In the trading companies, a significant change in duration took place in entering data into the internal MIS. While data were entered three times in the three sites involved - finance team, assisting department and business teams - before KTNET, data entry is done only once in business teams after KTNET. Furthermore 80% of the data are already entered in files transmitted from banks through EDI. Therefore the time spent for entering data was significantly reduced. In the bank, duration is also reduced because printing out texts and making 2 sets of L/Cs are eliminated. In both sites, the elimination of time which was spent for delivering documents between departments in the trading companies and between the headquarters and branches in banks was not mentioned. That time is reflected when cycle is considered later.

b. Sequence

Sequence refers to the order in which activities and tasks take place. The number of steps (unit tasks) was reduced from 6 to 4 in the trading companies and from 7 to 3 in the bank, but the basic order of work was not changed.

c. Temporal location

Temporal location is the location of activities and tasks at particular points over the continuum of time. The locations of delivery and collection of export L/Cs, both sides of the same coin depending on the point of view (delivery from the banks' viewpoint and collection from the trading companies' viewpoint), were relatively fixed on specific times of the day. For example, in the bank the delivery usually took place in the morning and at 2:00 p.m. Now the bank transmits the export L/Cs when a reasonable number of L/Cs are ready to be sent to meet the customer companies' need - they always want to know as early as possible whether the L/Cs for the confirmed export orders have arrived. That means in the trading companies' side that they can retrieve documents when necessary.

d. Deadline

Deadline is the fixed time by which work is due to be done. In the export L/C procedures both in the trading companies and the bank, rigid deadlines do not seem to exist. The work was and is being done daily and ordinarily without any special time pressure, that is, deadline. Although there are relatively and customarily, in particular under the new system, fixed temporal points at which deliveries are made, they are not considered to be deadlines because a specific L/C which has arrived in the bank, for example, can be delivered in the next delivery (2 p.m.), if it is not delivered in the morning time. The speedy process is preferred, but not essential for every L/C.

e. Cycle

Cycle means the periodic regularity in which work is completed repeatedly. As described previously, in the trading companies, the completion of export L/C from the collection to the final data entry in business teams used to take about a week. Under the new system, the cycle has been reduced to one or two days.

Previously the bank processed on the working day export L/Cs which arrived by 2 p.m.. Export L/Cs coming after 2 p.m. were processed the next morning. Therefore it delivered them twice a day. The time of division, 2 p.m. here, is called 'cutover time' (named in English by the main informant in the IS department in the bank). The cycle of cutover time usually coincides with one day cycle, especially where the speed is not important. It tends to be getting shorter as the importance of speed increases. Under the new system, the cycle of cutover time is likely to get shorter. Before KTNET, a day was divided into two parts at the point of 2 o'clock in the afternoon; now electronic transmissions happen 4-6 times per day, about every 2 hours. EDI has a potential to affect cutover time, which means that it shortens the cycle of business operations.

f. Rhythm

Rhythm refers to the alternation in the intensity of being busy within a cycle. Work in export L/C advice goes in a even, flat rhythm in trading companies and banks before and after KTNET alike. That means there are no hectic hours as regards the export L/C advice. It may be partly due to the absence of deadline.

Table 5-1. Changes in temporal dimensions of export letters of credit

Dimensions	Before KTNET (upper cells - trading companies; lower cells - banks)	After KTNET (upper cells - trading companies; lower cells - banks)
Duration (of unit tasks)	* data entered 3 times in the three separate departments involved * printing texts and making 2 sets of L/Cs	* data entry once; 80% of data already entered by banks * eliminated
Sequence	* 6 steps * 7 steps	* 4 steps; no change in basic order * 3 steps; no change in basic order
Temporal location	* collection time relatively fixed * delivery at a fixed time twice a day (in the morning and 2 p.m.)	* being able to retrieve when necessary * transmitting at unspecified times (and more frequently)
Deadline	* no deadline * no deadline	* no deadline * no deadline
Cycle	* 7-8 days * cutover time twice a day ; half a day cycle	* 1-2 days * cutover time 4-6 times a day ; about 2 hours cycle
Rhythm	* even and flat * even and flat	* even and flat * even and flat

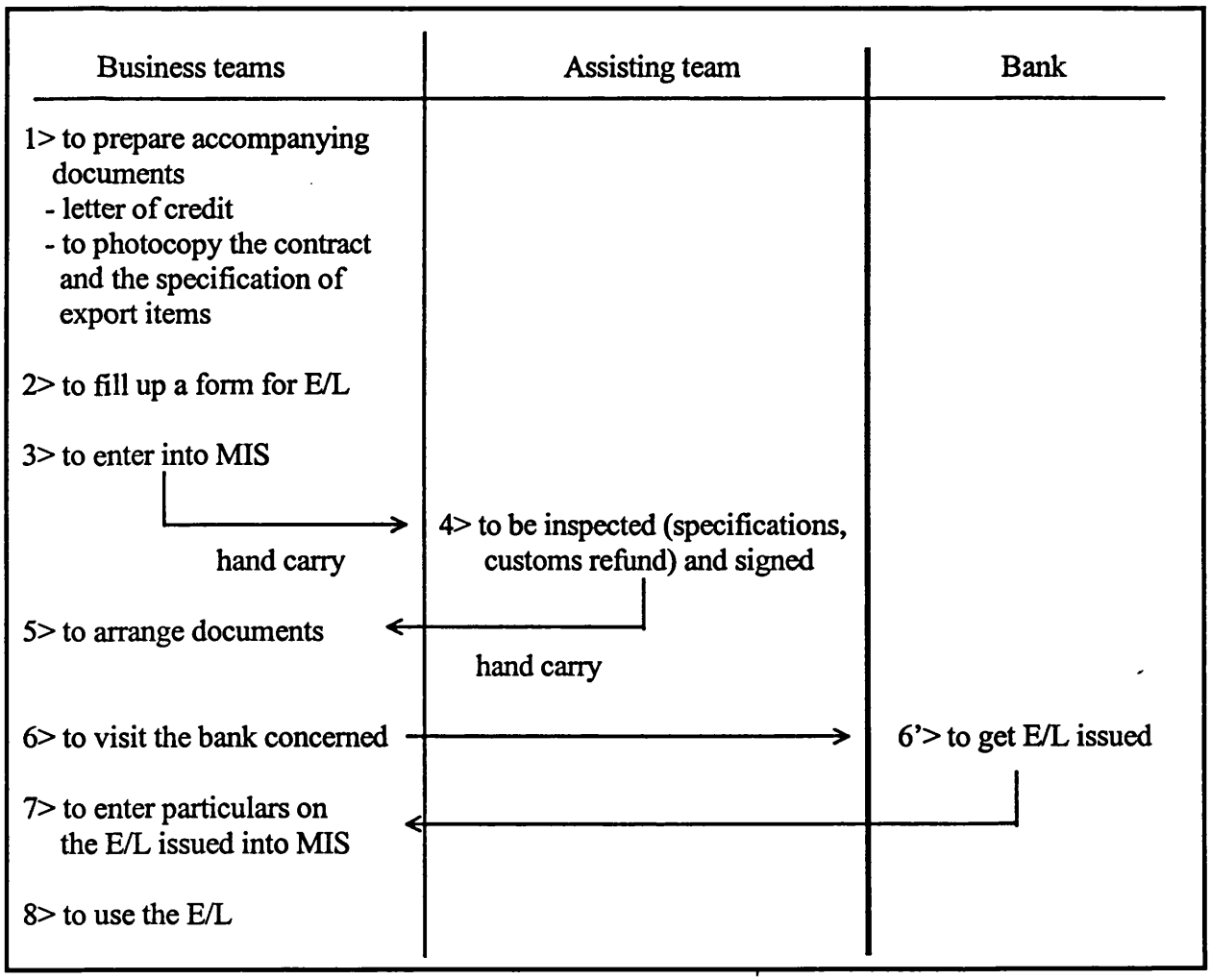
C. Export Licences

1. Procedures in trading companies

After receiving export L/Cs, trading companies need to gain export licences from banks or appropriate manufacturing associations depending on the item which they deal in. In this section, transactions with banks are described.

a. Before KTNET

Figure 5-6. Previous procedures for export licence before KTNET in trading companies



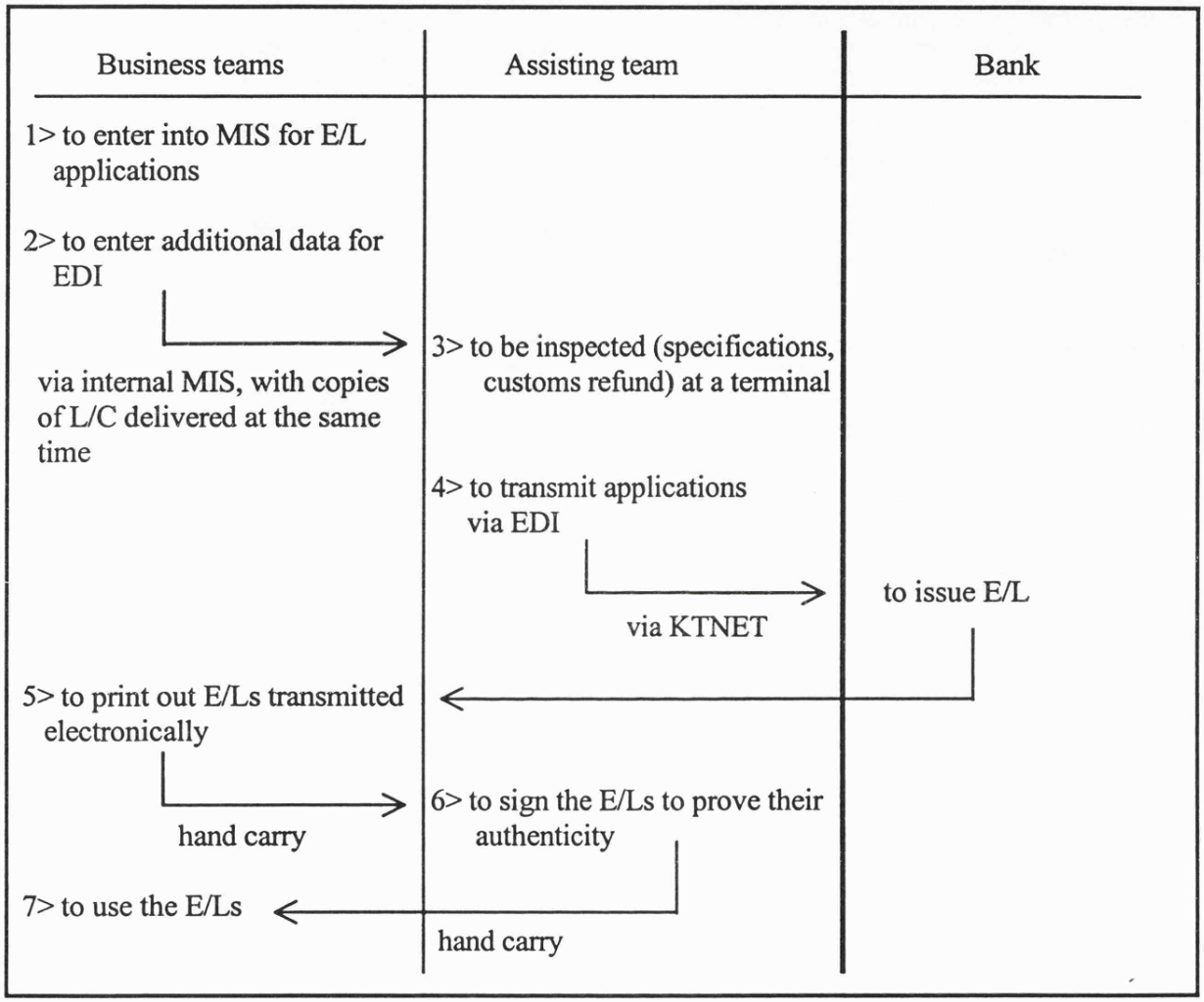
The female clerk in charge of E/L in business teams prepares for its application. She attaches the letter of credit to photocopies of the contract and the specification of export goods and fills up a form for E/L application. Then she enters data into MIS and carries the set of documents in person to the assisting department, where documents are inspected and signed

unless faults are found. After collecting the documents, she makes a final arrangement for the application and goes to the bank with them. The clerk in each business team usually visits the bank once a day, where she spends at least about 30 minutes, but normally 1-2 hours waiting for the issuance of E/L. Returning to the office, she enters some data in the E/L issued into MIS and uses it for the next step of export procedures. In the above process, steps 3> and 7> did not always take place at the fixed places in the process. When busy, they could be performed together later after each E/L was issued.

The clerk in the assisting team used to deal with one or two applications at one time. It did not take her much time to process one or two applications. However, several business teams brought their applications irregularly and sporadically throughout the working day, and they wanted to have their applications processed immediately. Therefore it was difficult for her to deal with other tasks properly. She was not able to continue with something without being interrupted by the E/L applications. In other words, she found it difficult to make a schedule for E/L and, as a result, other tasks. The clerk in charge of E/L in the assisting team commented, "E/Ls happen quite often and irregularly, so they cause other businesses to cease in the halfway," which sometimes caused her to get lost in the work flow. She added, "All E/Ls are thought to be urgent, so we deal with them one by one. We can't wait for them to gather in a bundle, and process collectively."

b. After KTNET in Sunkyong

Figure 5-7. Current procedures for export licence after KTNET in Sunkyong



Under the new system, the E/L procedure starts with the entry into MIS for application by a clerk in business teams. Then additional data for EDI need to be entered. Data in MIS are sent to the assisting team for inspection. At the same time, copies of L/C are delivered over to the team. The clerk in charge in the assisting team inspects whether the entry is correct, comparing the content on the paper L/C and the data entered on the screen. Then she transmits the applications for E/L through KTNET to the bank. The bank returns via KTNET E/Ls which are issued in electronic form. They are received and printed out in business teams. Then the printed E/Ls are carried to the assisting team, where they get stamped to prove their authenticity. The E/Ls with signs on them are returned to the business teams for use.

As seen above, the new EDI method does not require certain documents such as L/C and the contract to be attached to the E/L application form. In terms of temporality, it has also brought significant changes worth noting. Sunkyong and the banks involved set the times for transmitting E/L applications three times a day: 10:40, 13:40 and 15:00. Banks return the E/Ls issued at 12:00, 15:00 and 16:30 respectively. Therefore, business teams have to send applications before the three set times. Most applications are made in the morning. Goods to be exported usually pass customs clearance before noon, and therefore, the export licence has to arrive in the company before 12:00.

In the present system, the E/L clerk in the assisting team is able to make a schedule for the day. Before KTNET, the clerk could not do anything else properly because applications for E/L came from several business teams quite irregularly and sporadically throughout the working day, although the majority arrived in the morning. Under the new system, they come regularly at the fixed times. So she can deal with other jobs while waiting for them to come. "It's a kind of multitasking, which was unthinkable under the old system," said the IS staff in Sunkyong. The E/L clerk in the assisting team expressed the contentment with the new system as follows;

> It is convenient to set specific times for the work, and therefore to be able to make a schedule for the day. I can prepare for tasks in advance.

She added, "the clerks in business teams probably come to be able to make such a plan for the work". However, when the same question was asked of a clerk in a business team, expecting similar reactions, she did not agree, saying that "we used to and do make a schedule to such an extent." For her, there seems to be nothing special with the new system in terms of scheduling. According to her, it cannot be said that any difference emerges in the organisation of time. Another clerk in a business team had the same view on the matter.

> It (the new possibility of organising time - by the author) applies only to the assisting team. The team transacts with several business teams. When business teams ask the team to process their orders at the time they want, the team has to do it, which means that the clerks in charge in the team cannot concentrate on tasks other than E/L. They had to respond spontaneously. Their work time was often interrupted by E/L requests. Now the new system has enabled the team to ask business teams to bring work at specific times of day.

Business teams do not gain such an advantage from the new system. It seems to be due to the fact that clerks in charge of E/L in business teams take responsibility for several tasks other than E/L.

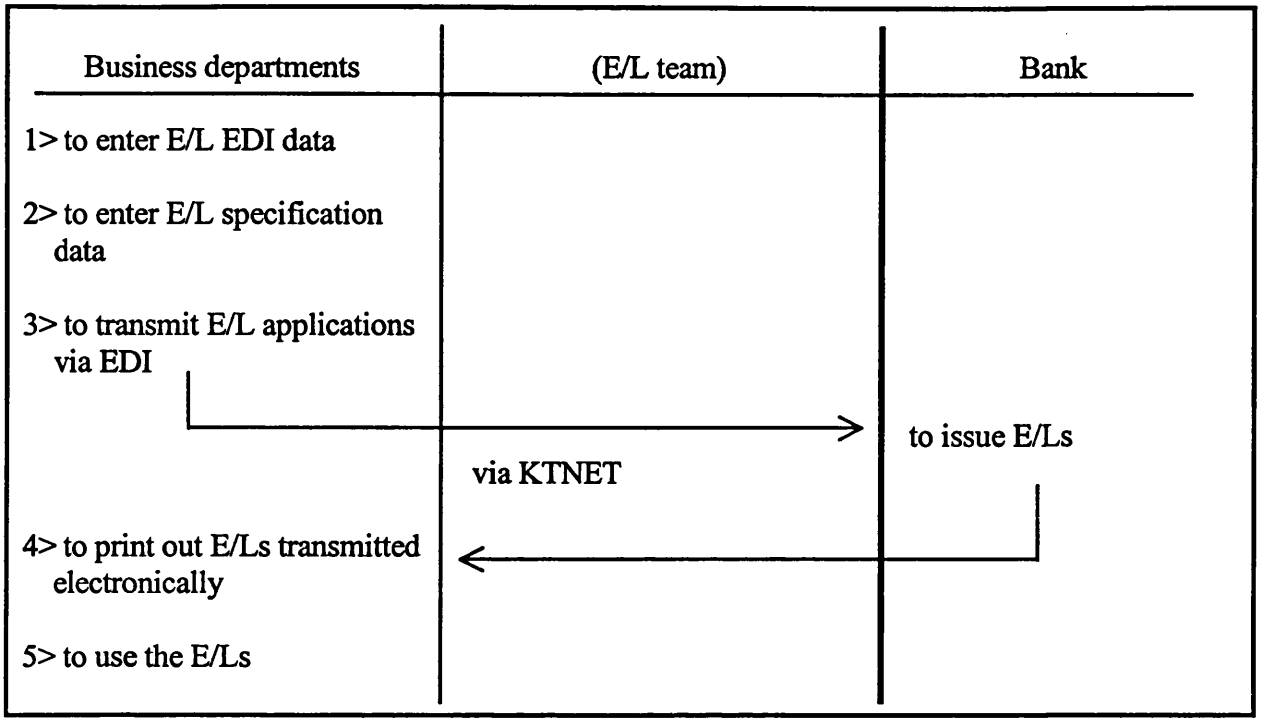
They deal with all the processes related to one export order including L/C advice, local L/C and so on. The new arrangement of E/L job does not seem to benefit clerks in business teams in terms of the organisation of time as it does for the assisting team.

Instead, the new system has imposed a new temporal restraint on the workers in business teams. In the past, they had to visit the banks under their charge, normally twice a day, in the morning and in the afternoon. Presently they transmit electronically E/L applications twice a day, at 11:00 and 15:00, (although there is one more time, 14:00, it is not used much) via the internal MIS. They do not have to go to banks in person at all, which is a benefit to them. However, they have to meet the newly set times, namely 11:00 and 15:00. They consider the times as deadlines which have not existed so far. The clerk interviewed in business teams added that for the system to succeed, it should allow E/L applications to be transmitted anytime whenever necessary. This is realised in Daewoo where the EDI system is applied in a more advanced form, which is described in the following.

c. After KTNET in Daewoo

A sophisticated system for E/L has been developed and put into use in Daewoo. The system has evolved in three stages. The first two stages are similar to the before and after procedures in Sunkyong described above except that Daewoo had a special team for E/L processing. Unlike in Sunkyong, the team took the responsibility to visit banks with E/L applications. Here only the last stage in Daewoo is presented.

Figure 5-8. Current procedures for export licence after KTNET in Daewoo



What is different from Sunkyong is the removal in the E/L process of an assisting team. Previously, both in the manual and transitional stages, corresponding to 'before and after KTNET' in Sunkyong respectively, the assisting department existed in the intermediary. It was named the 'E/L team' because its only task was to deal with E/L. Workers in the team received E/L applications from business departments and took them to banks. Although the team still remains, it conducts only some residual work related to E/L.

Now in Daewoo workers in business departments can transmit E/L applications directly to banks via EDI *whenever they want*. Under the manual system, there were rigid deadlines. Namely, workers in business departments had to hand over their E/L applications to the E/L team whose workers visited banks twice a day at relatively fixed time, before noon and in the afternoon. However in Sunkyong where workers in business teams carried their own E/L applications in person to banks after getting them inspected and signed in the assisting team, such deadlines did not exist. They processed E/L according to their own schedules or requirements of specific E/Ls. Under this EDI system in Daewoo, tellers in banks check and respond every hour. Only when an E/L is urgently needed, workers in business departments can make a phone call to the appropriate bank, and ask for special, immediate treatment.

2. Procedures in banks

a. Before KTNET

Figure 5-9. Previous procedures for export licence before KTNET in banks

1> to receive E/L application forms from customer companies with accompanying documents (L/C, contract, offer sheet, recommendation, etc.)

2> to record in the E/L ledger, give E/L registration numbers according to the bank's numbering system and enter data into the internal system

3> to examine documents according to regulations of customs clearance for export

4> (of a supervisor) to sign

5> to issue two copies of E/L for the company and the customs office

Trading companies bring E/L applications sporadically throughout the day although there is a rule of thumb regarding when they come as far as a specific company is concerned. It does not take long to process the applications. Normally the bank returns them when the E/L clerks of trading companies visit later in the afternoon of the same day or the next morning. When a company asks for immediate treatment, the bank can process it while a worker from the company waits in the branch, even within ten minutes.

b. After KTNET

Figure 5-10 shows how EDI messages of export licence flow among the headquarters, branches and customer companies.

① Trading companies transmit E/L applications, which pass through KTNET and KFTC.

② The EDI system at headquarters verifies items in the standard form and then sends control messages of normal receipt or error.

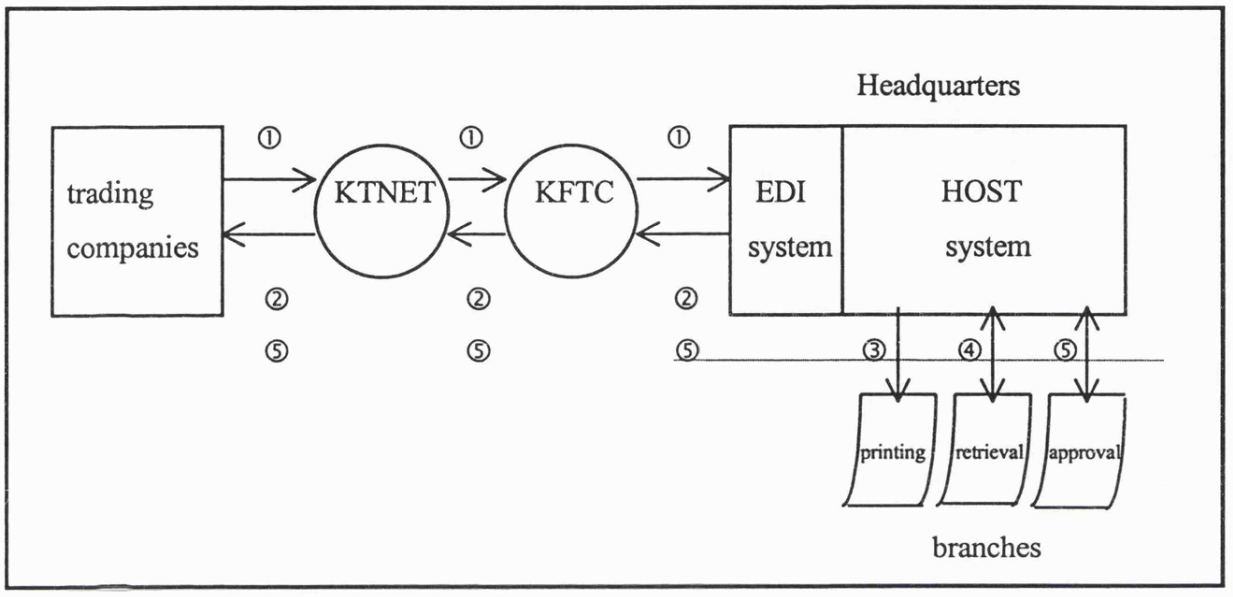
③ The host system at headquarters gives a notice of registered E/L applications to the appropriate branches through receive-only-printers. Each branch has a receive-only-printer through which the host computer sends some information to the branch. It prints out E/L applications for which the branch is responsible.

④ From applications printed out at step 3, a worker in charge of E/L at the branch can retrieve an

application in detail which should be processed.

⑤ Branches send the approval (disapproval) messages, which reach trading companies via KFTC and KTNET.

Figure 5-10. The flow of EDI messages of export licence



E/L applications which arrive in the appropriate branches are processed as described in Figure 5-11. Under the new system, workers in trading companies do not visit banks for E/L. They send applications via EDI and receive approved E/Ls in electronic form. In bank branches, tellers do not have to receive their customers of E/L business and their work time is not interrupted by irregular and unexpected visits. It was interrupted in the past although there used to exist a rule of thumb, at least as far as E/L is concerned. Now tellers check at their terminals E/L applications received through KTNET at the agreed times with the companies or at a regular interval (e.g. every hour). However this advantage of KTNET is not fully realised as in the assisting team in Sunkyong because banks have a wide of range of customer companies, among which many small-and-medium-sized companies do not use KTNET yet. They cannot afford it in terms of costs as well as the small number of E/Ls they deal with. Therefore bank branches have to process E/L in both ways, old and new. In step 2 in Figure 5-11, printing should be done in principle before transmitting the approval messages to the companies concerned. When busy, however, E/Ls are approved and transmitted first, and later they are printed out collectively.

Figure 5-11. Current procedures for export licence after KTNET in banks

1> (of a teller in charge of E/L in branches) to check regularly E/L applications received at his/her terminal

2> to print out E/L applications for later reference

3> (of a supervisor) to approve

4> to transmit approval messages to the company concerned

3. Changes in the six dimensions of temporal order

a. Duration

Under the new system, trading companies do not have to prepare accompanying documents such as L/C and the contract. It reduces the duration significantly, let alone the time spent visiting banks.

In banks, duration is also reduced because tellers do not receive workers from customer companies and because some paper work is eliminated. Instead work is done at terminals. In addition tellers do not have to enter data from applications into the bank system because most data is already in the EDI system. It takes a relatively long time to print out applications received via EDI for later reference. However, because printed application forms are not indispensable to the process of E/L through KTNET, they are printed out collectively later when tellers are not busy. Therefore, printing does not affect the whole duration much.

b. Sequence

Before KTNET, data entry into MIS did not have to be conducted at fixed points (steps 3 and 7) in the process. Because MIS was separated from the process of E/L itself, it was possible to skip it and to enter data collectively later when less busy. Under the new system, the whole process begins with the data entry, which cannot be omitted. MIS is directly connected to the work of E/L procedures.

In banks, all the steps were performed in the order described before KTNET; now printing is often skipped when busy and is done collectively later when less busy.

c. Temporal location

Previously, although there existed a rule of thumb about when to do it, E/L applications came to the assisting department and then to the bank irregularly during the working day,. Presently, however, applications take place in Sunkyong at fixed times and the bank sends the E/Ls issued at the corresponding fixed times. In Daewoo which has implemented a more advanced system, applications are made at any time of the day whenever they are necessary.

E/L tellers in banks, under the manual system, had to deal with applications whenever customers brought them. They could anticipate to some extent when they would come in by experience, but the arrivals of applications were irregular. The temporal location of the E/L work was sporadic. Under the EDI system, trading companies and banks made an agreement on the time of transmissions for application and approval. As a result, E/L clerks in branches treat E/L applications on a regular basis, perhaps twice a day or even every hour. They can anticipate and plan their work schedule.

d. Deadline

Here we need again to distinguish between Sunkyong and Daewoo. For the workers in the business teams in Sunkyong, the newly fixed times function as deadlines by which they have to apply for E/Ls which are expected to be necessary for the working day. Previously such deadlines did not exist in Sunkyong because workers in business teams carried their own E/L applications in person to banks after a short inspection in the assisting department. They processed E/L according to their own schedule or requirements of the specific E/L.

In Daewoo, in contrast, there were rigid deadlines under the manual system. The difference lies in the fact that in Daewoo workers in the business departments did not go to banks in person but a special team for E/L visited banks. Therefore workers in the business departments had to hand over applications to the E/L team before the set deadlines twice a day. With the advanced system implemented, such deadlines disappeared. Applications can be made at any point of time in the day whenever necessary.

For tellers in banks, no deadline exists in the sense described above. When customer companies apply for E/L in person or electronically, they respond to them within a reasonable time. They do not consider that there is a deadline which should be met in responding to them.

e. Cycle

Previously, both in Sunkyong and Daewoo, there existed an approximately half a day cycle in processing E/L, although Sunkyong's is less regular. In this cycle, workers in charge of E/L visited banks twice a day; applications which were submitted before lunch time were collected in the afternoon whereas those submitted in the afternoon were returned the next morning.

In Sunkyong's new system, there are now three cycles a day which begin at 10:40, 13:40 and 15:00 and finish 12:00, 13:00 and 16:30 respectively. Daewoo has shorter cycles in which applications are sent whenever necessary and the bank responds every hour.

What happened in the trading companies, i.e. the shortening of cycles, is also true in the banks, although its influence is less noticeable in banks because banks cover a wide range of customers, as mentioned already.

f. Rhythm

There is no difference in rhythm before and after KTNET whether in the trading companies or the banks. Regardless of shorter cycles, most work arises in the morning. So most workers in charge of E/L are busier in the morning than in the afternoon. There is also no difference on the weekly basis. Mondays and Fridays used to be, and are still, busier than other weekdays.

Table 5-2. Changes in temporal dimensions of export licence

Dimensions	before KTNET (upper cells - trading companies; lower cells - banks)	after KTNET (upper cells - trading companies; lower cells - banks)
Duration (of unit tasks)	* to prepare some documents to be attached * receiving customers with E/L; data entry necessary	* some paper work for the attachment removed * no visit from companies; data already put in the EDI system by the companies
Sequence	* entry into MIS in the process often omitted to be conducted collectively later, even a few days later * performed in the order specified	* the whole process beginning with entry into MIS, which cannot be omitted. * printing often skipped and performed in a bundle later
Temporal location	* happening relatively irregularly and sporadically in Sunkyong ** relatively fixed times, before noon and in the afternoon in Daewoo * sporadic and irregular	* in the fixed times which are arranged between Sunkyong and banks ** at any time when E/L application is necessary * fixed and regular in transactions with companies using EDI
Deadline	* no deadlines in Sunkyong ** rigid deadlines in Daewoo * no deadline	* three set times arranged, the most important one is to 10 a.m. in Sunkyong ** deadlines disappeared in Daewoo * no deadline
Cycle	* about half a day cycle, repeating twice a day * about half a day cycle	* shorter cycles of three times a day or more frequent times * shorter cycle
Rhythm	* busy in the morning; Mondays and Fridays * busy in the morning; Mondays and Fridays	* the same * the same

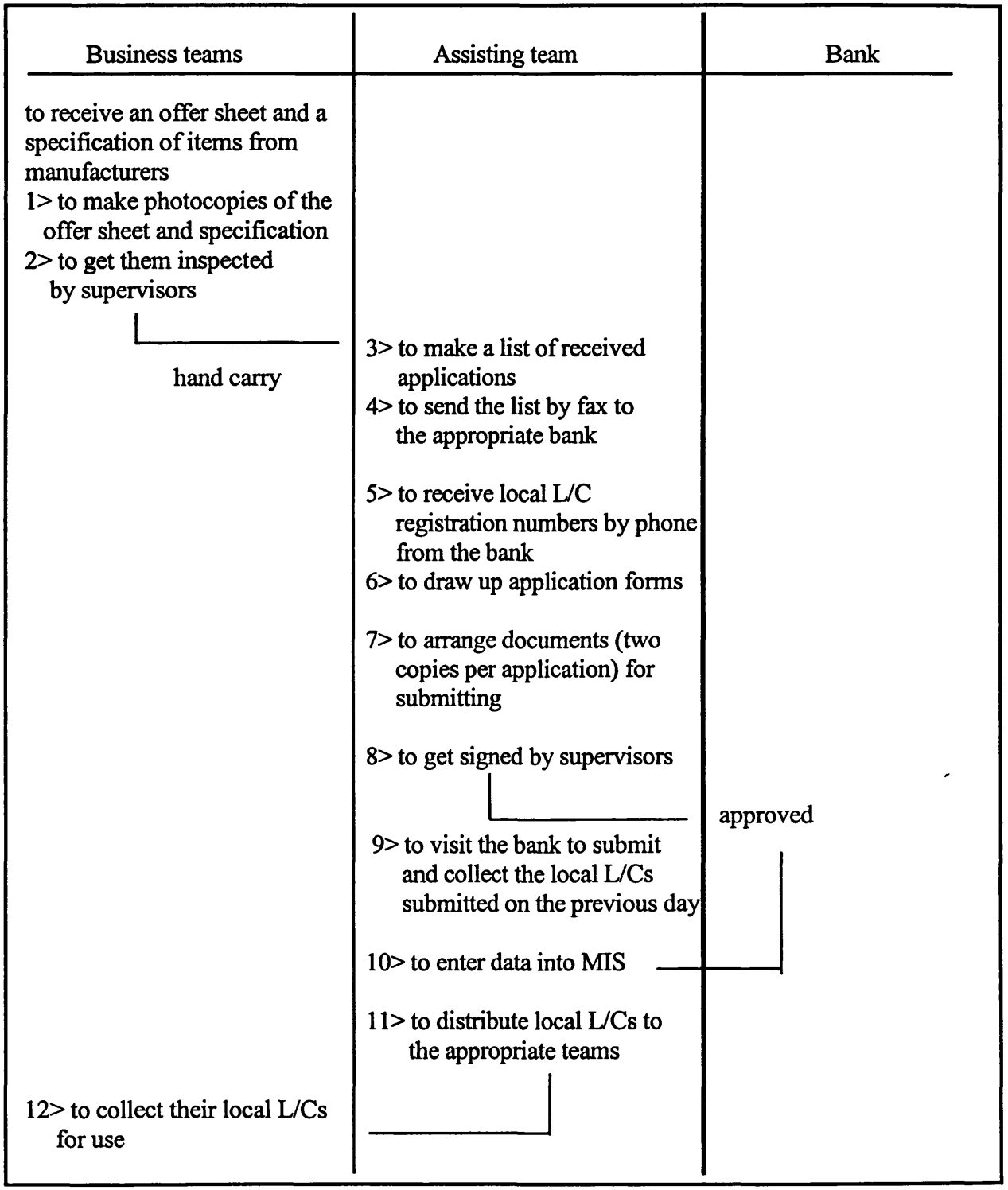
D. Local Letters of Credit

A local letter of credit is a domestic version of a (master) letter of credit. Its principle and function are the same with those of the master L/C except that the parties concerned (exporters, manufacturers which supply the goods to be exported, and banks) are all located within the same national territory. It is issued by a bank (the advising bank of the master L/C) at the exporter's request using the master L/C as a collateral. Beneficiaries are manufacturers or suppliers of the export goods. They get paid regardless of the terms in the master L/C once they deliver the goods within the promised date and hand documents over to the bank as specified in the terms of the credit.

1. Procedures in trading companies

a. Before KTNET

Figure 5-12. Previous procedures for local L/C before KTNET in trading companies

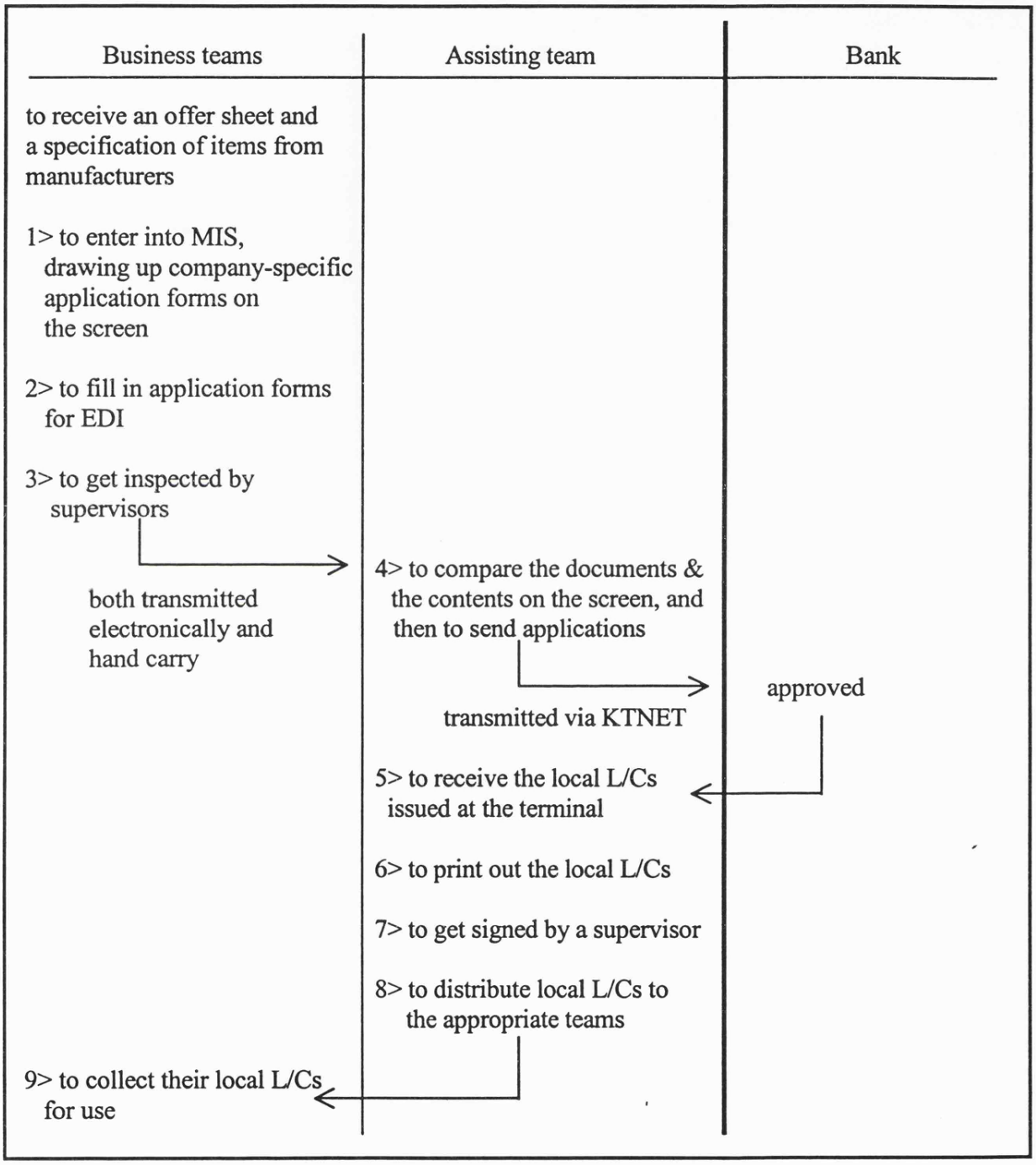


After business teams receive offer sheets and specifications of the export goods from manufacturers or suppliers, they begin to prepare for local L/C applications. Female workers make photocopies of the documents, get them inspected, and take them to the assisting department by 11 a.m. The documents have to arrive by then to be processed properly during the working day.

The workers in charge in the assisting team enlist the day's local L/C applications, breaking down by bank and currency. They fax the list to the appropriate banks between noon and 13:00. The banks briefly notify registration numbers by phone. Then they fill in the application forms and arrange necessary documents for submission. After the supervisor signs the forms, they go to the appropriate banks, usually at 16:00. In this visit, they not only submit the day's applications but also collect the local L/Cs applied in the previous day. Returning to the office, they make data entries into MIS and then classify local L/Cs by business team and distribute them. When they are busy, the data entry is often postponed. It can be done by batch later.

b. After KTNET

Figure 5-13. Current procedures for local L/C after KTNET in trading companies



Under the EDI system, workers in charge of local L/C in business teams enter data into the system, instead of making photocopies of documents. Data entry consists of two parts; one is for the internal MIS, the other for the EDI process. Then applications in electronic form are transmitted to the assisting team with the relevant documents being sent at the same time. In the assisting team, the documents on paper and the contents in electronic applications are compared. If no error is found, or after any correction, then applications are transmitted via KTNET to the banks. It takes just ten minutes to compare and transmit. The transmission takes place between 11:00-13:00 in Sunkyong and 13:00-14:00 in Daewoo as agreed with the banks concerned. The local L/Cs issued return to the company around at 17:00 in Sunkyong and at 15:00 in Daewoo. It takes about 30 minutes to print out them. Business teams usually collect their local L/Cs the next morning.

As they did under the manual system, the workers in business teams have to complete the entry before 11 o'clock. It is a deadline, but now it is less rigid than before KTNET. Previously, there was much work for the assisting team to do before submitting local L/C applications to the banks, which used to take 3-4 hours. In order to be able to submit on the same working day, the 11 o'clock deadline was very important, and now it is not under the new system. A clerk in charge of local L/C in the assisting team in Sunkyong commented:

> The treatment of local L/C is a small part of the whole work for the workers in business teams. However, this is my major duty. The business teams quite often missed the 11 o'clock deadline when they were busy. Therefore I always used to urge and press them repeatedly to meet the deadline, which meant lots of uneasiness between us and the workers in business teams. Now this kind of trouble has almost disappeared because we are not tied up with the deadline that firmly. Though still we have to transmit the applications to the banks between 11:00-13:00, there is not much work to do before the transmission. It is not as urgent as it was. My position toward business teams has changed from urging to helping.

Now, after applications for local L/C arrive via MIS and by hand delivery, there is less work for the assisting team to do than before. Therefore the pressure to be punctual has decreased, and the assisting team does not urge business teams much to be punctual. Even when business teams do not turn them in on time, it is not pressing for the assisting team. For workers in business teams, however, it has made little difference; the workload has increased mainly because the data entry was allocated to them. It has to be done by noon at the latest. For them the deadline still remains to be met although it is said to be less rigid.

2. Procedures in banks

a. Before KTNET

Figure 5-14. Previous procedures for local L/C before KTNET in banks

1> to receive applications with accompanying documents

2> to check the credit limit of the applicant company and approve it

3> to register the opening of local L/C at a terminal
- local L/C information database adjusted; the credit limit and fee

4> to print out local L/C

5> to make a full set of local L/C
- to make a photocopy of the offer sheet and attach it to the local L/C

6> to get L/C signed

7> to hand it out to the applicant or the beneficiary

After receiving local L/C applications, tellers in branches check the credit limit of the applicant company. Local L/C is a sort of loan to applicant companies, so there is a limit depending on the assessment of the companies' financial situation and the transactional history with the bank. In large branches, tellers in the loan line and the export/import line share this job of local L/C, the former doing the step 1 and 2. If the application is approved, the teller in charge registers the opening of local L/C on the host computer at her terminal and get the credit limit and fee readjusted in the database. Then she prints out local L/Cs, makes four full sets with other documents, and gets a signature from her supervisor. The procedures described above are usually completed on the same working day. Since applications arrive late afternoon, usually about 16:00, substantial work is done after then. Local L/Cs issued are collected by applicants or beneficiaries at the next day's visit.

b. After KTNET

The message flow in local L/C is the same as that for export licences.

① Workers in trading companies transmit local L/C applications, which pass through the EDI

network and arrive in the branches concerned.

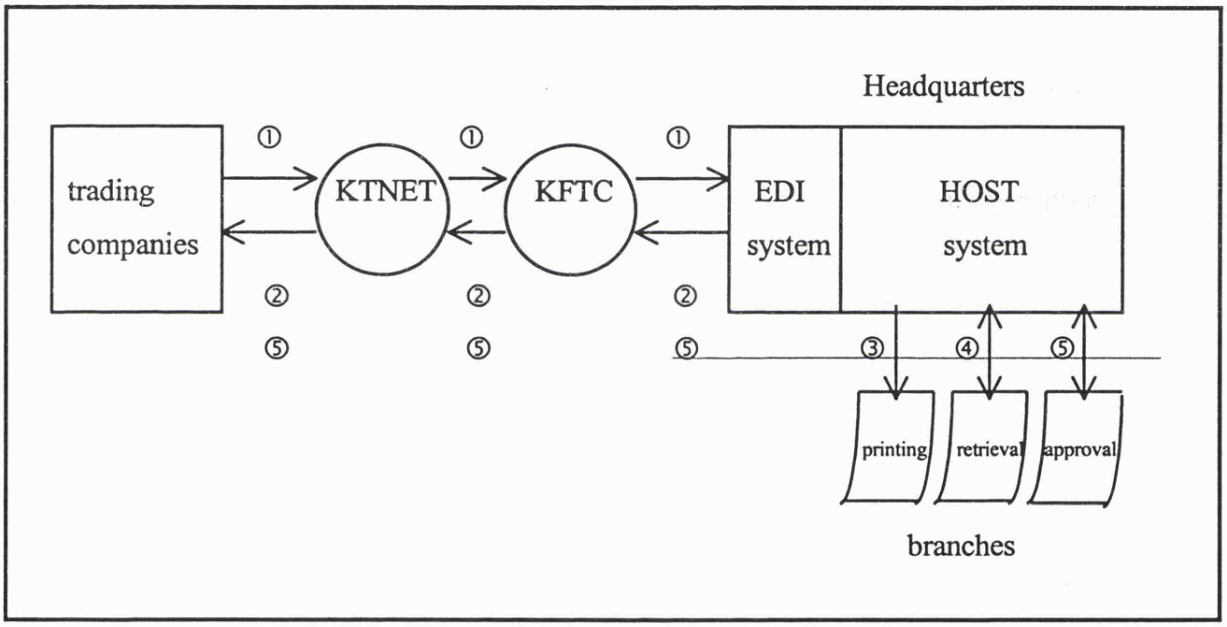
② The EDI system verifies items in the standard form and then send control messages of normal receipt or error.

③ The host computer gives a notice of registered local L/C applications to the appropriate branches through receive-only-printers.

④ Workers in charge at branches retrieve the applications in detail when necessary.

⑤ They send the approval (disapproval) messages, which reach trading companies via KFTC and KTNET.

Figure 5-15. The flow of EDI messages of local L/C



Then local L/C applications are processed in branches as described in Figure 5-16. A teller in charge regularly retrieves at a terminal the applications toward her branch. Before KTNET, when workers from trading companies visited, the teller received them and processed the applications. Although she was able to know by experience when they would visit, it was impossible to predict with accuracy. Under the new system, the teller sets the time when to retrieve and to deal with local L/C. For instance, the timing for transmission is agreed upon between Daewoo and Korea Exchange Bank. Daewoo transmits local L/C applications between 13:00 and 14:00, and KEB returns them by 15:00. In brief, while under the new system the teller can predict when to do something, i.e. make a schedule for the day, previously it seemed difficult for her to make a schedule for her job because she had to receive customers whenever they visited

sporadically. In addition, the data entry for the opening of local L/C has become simple, and the quantity of input data has reduced to one third because much data is already entered by the applicant companies.

Figure 5-16. Current procedures for local L/C after KTNET in banks

1> to retrieve the applications to the branch at a terminal and print them out for later reference

2> to register the opening of local L/C
- the credit limit and the fee accounting adjusted

3> to issue the local L/C and transmit it to the applicant

3. Changes in the six dimensions of temporal order

a. Duration

On the whole the duration of local L/C has been considerably reduced mainly by the elimination of some paper work in the assisting team. However the reduction does not benefit equally the parties concerned, or at least is not perceived as such. Part of the work which is eliminated from the assisting team is moved to business teams. Workers in business teams complain that they now enter data into the MIS and EDI systems, which was previously done by the assisting department. For the bank branches, some paper work is eliminated. There is no longer the need to receive in person customers who bring local L/C applications, and no more duplicate data entry is done, all of which have reduced the duration.

b. Sequence

In the past, the local L/C process was separated from the internal MIS, so the entry into the MIS took place after the whole procedure was almost finished, that is, at the tenth step of the twelve steps. It could happen at any time apart from the local L/C process itself. In practice the workers in the assisting department often omitted and postponed it. They conducted it in batch later when they were relatively not busy. Now the process is incorporated into MIS, and the whole process starts with the data entry. It is impossible to omit or postpone it.

For the bank branches, although the number of steps to complete the job was reduced from 7 to 3 and became simple, there is little change recognised in the basic order.

c. Temporal location

For business teams, there is little change in terms of temporal location. They deal with local L/C job in the morning (before noon) as they did previously. For the assisting team, before KTNET, the process spread throughout the whole afternoon. Now the process takes place at relatively specific time of the afternoon with duration being shortened.

Before KTNET, substantial work for local L/C in branches started at 16:00 after trading companies brought applications although tellers in charge had to prepare for it in the morning. Presently main work takes place in the early afternoon because trading companies transmit applications via KTNET around 11:00-13:00 (Sunkyong) or 13:00-14:00 (Daewoo).

d. Deadline

Before KTNET, business teams had to hand over applications to the assisting team by 11 o'clock. Because there was much work for the local L/C workers in the assisting team to perform before they submitted the applications to banks in the late afternoon (usually 16:00), they urged business teams to bring them in by 11 o'clock. The deadline of 11 o'clock was quite a rigid one. The new system makes a difference. Because preparatory work for local L/C application in the assisting team becomes reduced substantially, the worker in charge in the team is not insistent on having applications on time. Although the deadline still exists, it is now less rigid. Such change in the rigidity of deadlines has had an influence on the relationships of the involved parties, which is to be discussed in the next chapter.

Previously in the banks tellers completed the job before they left the office or, rarely, the next morning. Under the new system, they have to send the approved local L/Cs by the agreed time, for example, by 15:00 for Daewoo. However tellers do not consider this time as a serious deadline because it is not difficult to finish the job by then.

e. Cycle

Before KTNET, it took two working days for an application to return as an issued local L/C. For example, an application starts its journey in a business team in the morning, passing

through the assisting team, arrives in the bank in the afternoon, and is collected by a worker in the assisting team who visits the bank in the afternoon of the next day. It returns to the business team in the morning of the following day. Under the new system, it comes back to the assisting team from the bank in the afternoon of the same day, and is collected by the business team in the next morning. It takes one working day.

In addition, we can distinguish two separable, though connected, cycles in processing the local L/C. One is the cycle of one order being processed from an application to an issued one, namely the time required in completing one specific order (steps 1-12); the other is the cycle of workers' daily activities. Previously, the former was a two day cycle while workers in charge repeat the same job on a daily basis. Now the two cycles approximately coincide with each other by one day cycle.

The cycle of the job in banks from receiving applications to returning them has been reduced from a working day to less than half a day.

f. Rhythm

For business teams, there is no difference at all in terms of rhythm. Both before and after KTNET, they are busy in the morning. For the assisting department, there is some delicate change. Before KTNET, they were evenly and flatly busy throughout the afternoon. There was no point of stress. Presently they are busy at the specific times of the afternoon when they send applications and receive the local L/Cs. There emerge rhythmic stresses. In branches, there is a little shift from the late afternoon to the early afternoon. For both trading companies and bánks, no difference is found on the weekly basis.

Table 5-3. Changes in temporal dimensions of local L/C

Dimensions	before KTNET (upper cells - trading companies; lower cells - banks)	after KTNET (upper cells - trading companies; lower cells - banks)
Duration (of unit tasks)	* much paper work in the assisting team * much paper work and reception	* paper work eliminated * reduced duration with some paper work eliminated, no reception and simpler data entry
Sequence	* the data entry into MIS done later, usually after some local L/Cs accumulated and when less busy * 7 steps	* the whole process beginning with the data entry, not skipped or omitted for later treatment * 3 steps; simpler but least change in basic order
Temporal location	* (business teams) in the morning ** (assisting team) spreading throughout the whole afternoon * substantial work being done late afternoon	* in the morning ** at specific times of the afternoon * substantial work done in the early afternoon at agreed specific times
Deadline	* the rigid 11 o'clock deadline * in fact no deadline	* still existing, but loose now * a deadline emerged, but not serious
Cycle	* two cycles - the cycle of one order being processed: two working days - the daily cycle of workers * one working day	* both cycles being coincided by the reduction of the former cycle to one day * half a day
Rhythm	* (business teams) the busiest time of the day, around 11 a.m.; the busiest day of the week, Friday ** (assisting team) evenly busy through the afternoon * busy late afternoon	* the same ** rhythmic stress emerged * busy early afternoon

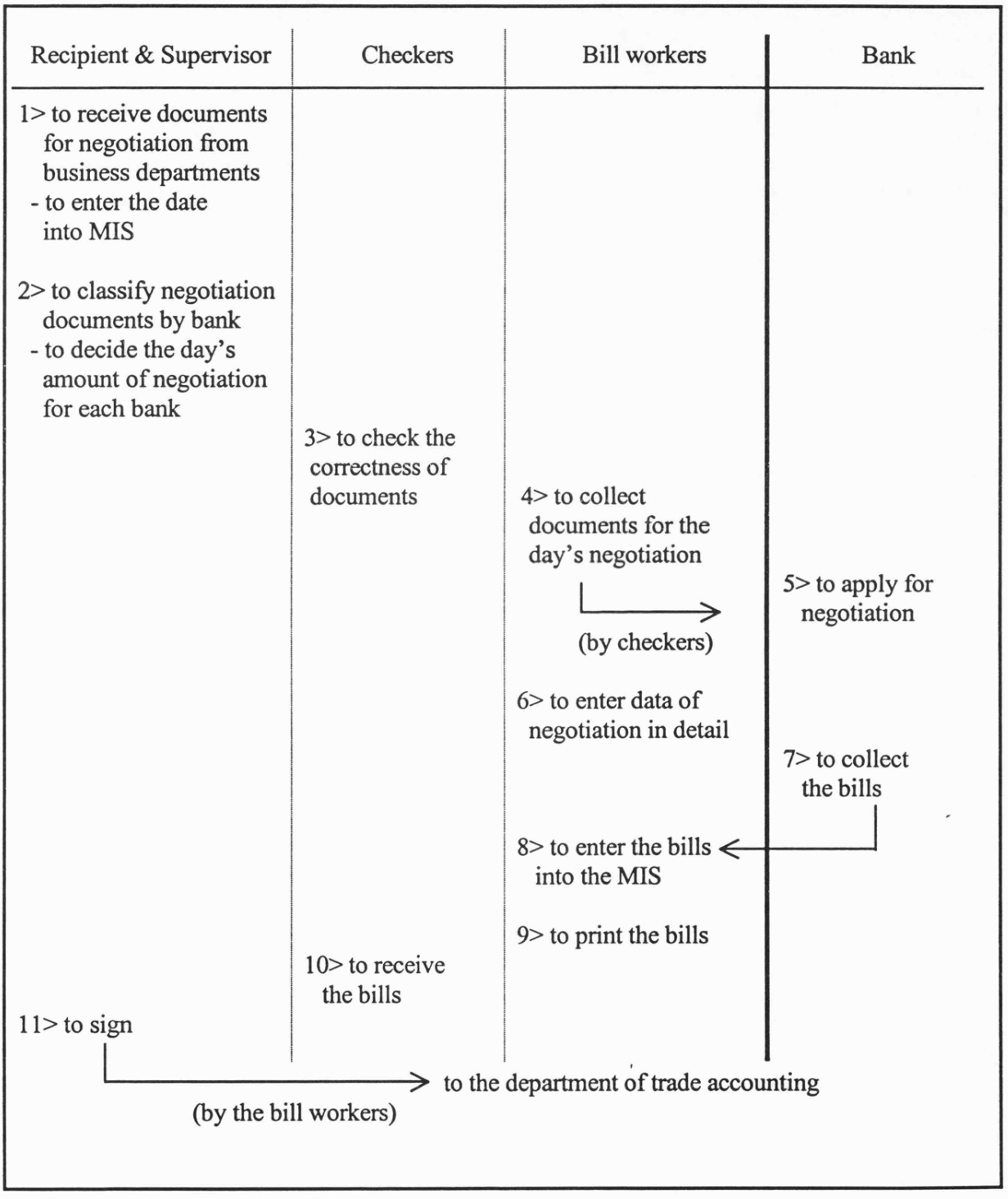
E. Negotiation

For trading companies, negotiation is the final stage of an export order which starts with the arrival of export L/C. It corresponds to stage 7 in the letter-of-credit cycle in Figure 4-1. Business departments prepare a set of documents and hand them over to the foreign exchange department. Negotiation is mainly conducted by this department which has frequent transactions with banks. By delivering a set of documents required by the terms on the letter of credit to the advising bank which is the paying bank here, the trading company is entitled to get paid for the export order for which the company has completed the requirements stipulated on the contract.

Descriptions of negotiation in this section are based on the fieldwork in Daewoo. The EDI systems for negotiation was implemented by Daewoo during the fieldwork period. This gave the author a good opportunity to observe and describe in detail changes in negotiation procedures comparing those before and after KTNET. Sunkyong had not implemented the negotiation system yet. According to the IS person in charge of the EDI development in Daewoo, the new negotiation system will cause a more significant organisational change in the foreign exchange department than any other system employed so far. The impacts of EDI negotiation systems on working practices in bank branches are yet limited. As will be described later, Daewoo have to submit in person various documents for negotiation to banks even under the new systems. It seems inevitable under current legal and technical conditions. While there has been much change in procedures within Daewoo, there is little when it comes to its transactions with banks. Only the bills are transmitted electronically from banks to Daewoo. On the bank's side, most of the work is similar. After documents for negotiation are delivered in the evening, bank workers enter them into their system which makes complex calculations on negotiations. Before KTNET, they printed out bills and handed them over to workers from Daewoo who visited the branches to collect the bills the next morning. Now they transmit them electronically. Temporal changes as regards negotiations in bank branches are minimal. Therefore this section deals with changes in working practices in Daewoo only.

1. Negotiation procedures before KTNET

Figure 5-17. Previous procedures for negotiation before KTNET



In the foreign exchange department, there are two different groups of workers as far as negotiation is concerned. One group, called 'checkers', is responsible for examining the correctness and consistency of data on various documents related to a single order. The other group conducts most of the tasks involved in negotiation such as data entry and other trivial jobs. They are called 'bill workers'. The division between the two groups is aligned with divisions of gender and education, although the connection is increasingly getting blurred. There are three females among seven checkers whereas there is no male worker in the group of six bill workers. Apart from them, there are three male workers who deal with orders whose payments are being delayed. There is also a male supervisor. It has been accepted that to compare documents, mainly written in English, is knowledge work which requires literacy in English and a certain degree of attentiveness. Male graduate workers have been allocated to the checker group. However the author's observation and partial experience of doing the job - the author made a few examinations of those documents for the sake of experience - revealed that the job did not require a high level of English literacy and attentiveness. The job was, for example, to check whether numbers across documents were correctly written. The English written on the documents cannot be considered ordinary easy English as it contains commercial and legal terms. But workers do not have to read all the sentences and most sentences are similar across documents. Such recognition of the job has recently been surfacing in the department and the direction for which the new EDI systems aim seems to reflect this reassessment as is described in the next section.

Documents for negotiation arrive in the department from business departments. Various documents are required for each negotiation, such as a summary cover, bill of lading, commercial invoice, insurance documents, packing list, country of origin certificate, a photocopy of L/C, bill of exchange, export permit, shipping advice and so on. The worker in charge of receiving them enters into the system the order number and the date. The supervisor of the department distributes negotiation orders received on the day to each bank. In so doing, he decides on the amount of money to be negotiated on the day for each bank. He has to finish the task by 10-11 a.m. in order that the finance department can know the amount of money (foreign currency) available for the day and make the day's plan for managing cash flow. Then the documents are distributed to checkers who take charge of specific banks. They begin to check documents. They examine, for example, whether the L/C numbers are put exactly on all the documents and whether all the documents required in the L/C are prepared. They check from around 10-11 a.m. when documents are allocated by the supervisor, to around 5 p.m. by when examination should be

completed and handed over to the bill workers. The latter time is an important deadline in the office.

The bill workers collect negotiation documents for the day. The amount of the day's negotiation for each bank is decided beforehand in the morning by the supervisor who considers the demands of the finance department. They fill in an application form for the day's negotiation. For a branch of Korea Exchange Bank with which Daewoo has transactions, they fax the form before they deliver related documents in person. It usually starts at about five o'clock and takes one and half to two hours. Then at around 6:30 - 7:00 p.m. the checkers with relevant documents visit the banks allocated to them and submit the documents for negotiation.

The bill workers enter negotiation data on summary covers and photocopies of invoices into the internal system. In principle this data entry takes place the next morning, yet it may happen two or three days later. In either case the data entry should be finished by 10 o'clock in the morning in order that the company may know the previous day's sales. The bill workers collect negotiation bills from bank branches. The time for bill collection is not fixed. It is done when they visit the branches for other businesses. Normally there are occasions in which they need to go to the branches. Having returned to the office, they enter data on the bills into the MIS. Doing this entry, they compare between the amounts (for example, of postage fee) on the bills issued by banks and the amounts which are calculated by the system and displayed on terminals. If differences are found, they correct data on the internal system or make complaints towards the bank concerned. Then they enter the banking charge, delay charge and cable charge on the bills into the system. This entry happens at unspecified times of the day. They print out the bills of their own and pass them to checkers, who get them signed by the supervisor. These two tasks also happen at unspecified times, i.e. when they are less busy.

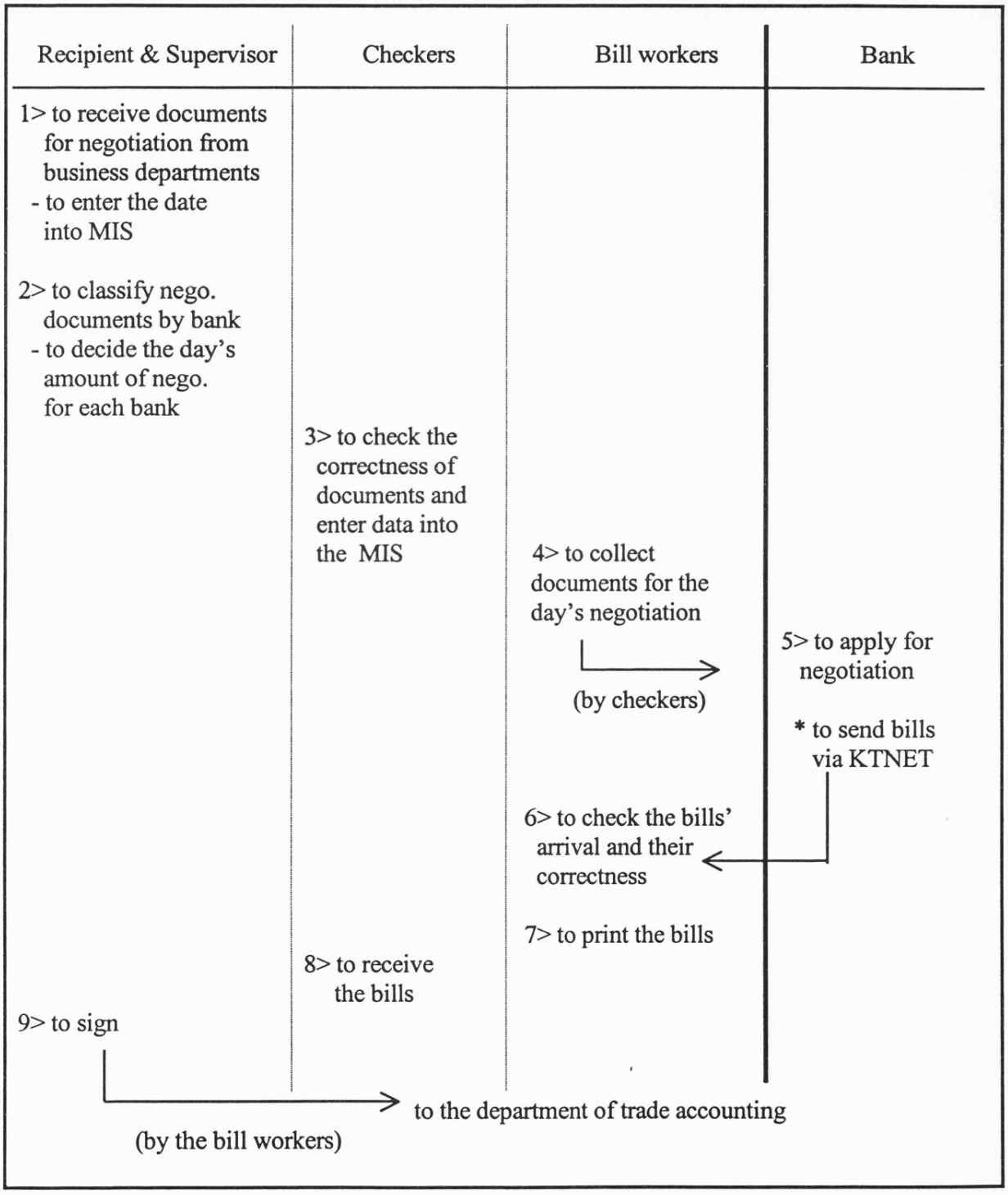
After the bills are signed by the supervisor, checkers return the bills to the bill workers, who deliver them to the trade accounting department. In principle, the signed bills are to be delivered to the accounting department every day. In practice, however, the bill workers do not process them on a daily basis as ruled in the company's regulations. They keep bills accumulated for several days on their desks and pass them to the trade accounting department in bundles. First of all, they are so busy that they cannot deal with them properly every day. The number of the company's export orders per year amounts to about 40,000. This means that the department has

to deal with 130 negotiations a day on average. On busy days, it can be more than 160-170 orders. In addition, the trade accounting department does not want to have them every day. The accounting department runs on a monthly basis, i.e. it closes the books at the end of every month to make a monthly report on final accounts. For this purpose, it sets deadlines by which other departments must submit their bills of transactions which have occurred for the month. The first deadline is usually on the 28th or 29th day of every month and the second one is on the 4th or 5th day of the next month.

The bill workers in the foreign exchange department pass the majority of the negotiation bills to checkers and the accounting department towards the end of every month although the bills become available evenly across the month. Therefore, as the deadline days approach, all the workers in the department get extremely busy. Work is not evenly distributed across the month, but concentrates on specific days of every month, usually on early days of, and towards the last day of every month.

2. Negotiation procedures after KTNET

Figure 5-18. Current procedures for negotiation after KTNET



A significant change since the introduction of KTNET is that the job of entering data has transferred from entry workers to checkers. Now checkers examine documents for negotiation as they did before, and at the same time enter related data into the internal system. They complained that their new job of simultaneous examination and data entry was an excessive work load. Behind the overt complaint, there is another grumble, though unspoken in public, that they are relegated to the data entry job which has been considered non-knowledge work and therefore suitable for female high-school graduate workers. However they accepted the direction which the department and the company chose for enhancing efficiency, and soon got accustomed to the new way of working.

Up to stage 5, working procedures are the same as before the introduction of KTNET. The new system removed bill workers' visits to banks for bill collection. Now the bank branches transmit electronically the negotiation bills after proper administrative work. Because all the data are already entered first by checkers and then by tellers in banks, bill workers only check whether the bills have arrived and examine whether they are consistent with calculations by the company's system. If differences are found, they correct them or discuss them with the persons responsible in the banks. Then the bills are printed out and passed to checkers to get signed by the supervisor. The bill workers transfer them to the trade accounting department. As the data entry is eliminated from the bill workers' work, i.e. as they are less busy, they can now deal with the delivery of the bills more frequently, which used to be done irregularly, that is, when they are relatively less busy. They now print out and pass to the accounting department fewer bills on a more frequent basis, which decreases the extent of work concentration around the early and last days of each month.

3. Changes in the six dimensions of temporal order

a. Duration

Apart from eliminating visits to bank branches by bill workers for bill collection, the duration of negotiation has been reduced by eliminating the data entry of negotiation bills, which is done now by bank workers. Regarding negotiation bills, identical data were entered twice in Daewoo and in the banks separately. KTNET enabled Daewoo to use data entered by banks. It is one of the most frequently mentioned advantages that the advocates of EDI boast of.

b. Sequence

In the previous system, the data entry for negotiation took place after negotiation documents were delivered to banks. In the present, checking documents and data entry are combined into checkers' hands, and the data entry precedes the collection of documents by bill workers for the day's negotiation. This shift in sequence is not the direct result of the new system. That means that the same shift may happen without the newly introduced EDI system. It is more appropriate to consider it as changes in working practices in order to enhance efficiency.

c. Temporal location

In terms of temporal location, there is little change in negotiation. The main tasks from step 1 to step 5 both before and after the new system take place at the similar times of day. The remaining steps happen at unspecified times of day. Because the bills which are collected (or transmitted) from the bank can be processed on batch, workers in charge normally conduct the remaining steps when they find (temporal) room for them.

d. Deadline

Major deadlines still remain as before. The supervisor decides on the amount of day's negotiation before 10-11 a.m., checkers have to finish by 5 p.m. and documents for negotiation have to be delivered to banks by 6:30 to 7:00 p.m. Although the deadline for checkers is the same, they seem to feel more pressured than before because of the increased work load. Monthly deadlines set by the trade accounting department remain too. The extent of work concentration around the deadline days seems to be reduced.

e. Cycle

We can distinguish three different cycles in processing the negotiations. One is the cycle of one negotiation order being processed from coming in the foreign exchange department to getting ready to be delivered to the accounting department. In principle it takes three days for an order to complete its journey. On the day when the order is received, it goes to the banks, and its bill returns the next day. On the third day the bill gets signed and ready to go to the accounting department. This three day cycle is the target of the foreign exchange department. In practice it takes four or five days. The second cycle is one of workers' daily activities. Workers repeat the same activities on a daily basis. There is little difference in these two cycles before and after KTNET.

The third one is the cyclical period during which negotiation orders are accumulated and processed in a large bundle. Previously bill workers kept bills from the bank in their drawers for several days, and handed a bundle of bills over to checkers on a weekly or a longer period basis. In fact towards the last days of each month a great majority of orders came to checkers. Since the launch of the new systems, the cycle has become shorter. Negotiation orders are handed over to the accounting department more frequently than before. As a result, the tendency of work concentrated towards the end of the month has been alleviated.

f. Rhythm

Previously, there was a time lag in the extent of being busy between checkers and bill workers. When a multitude of negotiation orders came to the department on a day, checkers were busy that day. The next day bill workers became busy to follow them up. This time lag is becoming blurred under the new system as the bill workers' work load becomes lighter.

Apart from the time lag, little change is found in rhythm of work. While checkers are busy in the early afternoon until around five o'clock, for bill workers it is just after five. And towards the end of month, both of them are getting busy although there is a difference of degree between before and after KTNET.

Table 5-4. Changes in temporal dimensions of negotiation

Dimensions	before KTNET	after KTNET
Duration (of unit tasks)	* duplicate data entry of bills both in Daewoo and the bank	* duration reduced by eliminating the duplicate data entry
Sequence	* data entry for negotiation taking place after the delivery to banks	* data entry for negotiation taking place before the delivery to banks
Temporal location	* steps 1-5 taking place throughout the day; the others at unspecified times	* little change
Deadline	* 10-11 am. for the supervisor; 5 pm. for checkers; 6:30-7:00 pm. for delivery to banks	* deadlines remaining unchanged
Cycle	* three cycles - the cycle of one order being processed, 4-5 working days - the daily cycle of workers - the cycle in which orders are accumulated and processed in a bundle	* little difference in the first two cycles * the last one being shortened
Rhythm	* time lag in the extent of being busy between checkers and bill workers ** busy in the early afternoon for checkers, late afternoon for bill workers *** busy on early and last days of each month	* the time lag getting blurred ** the same *** the same

Chapter 6
Analysis, Findings and Discussions

A. Introduction

In the previous chapter, the changes in work procedures were described. They have taken place since the introduction of KTNET in two trading companies and a bank. The description shows that the EDI systems have caused substantial changes in work procedures, which carried with them the shifts in the six dimensions of temporality. Changes in work procedures may be investigated from various points of view, for example, in terms of deskilling as presented in labour process theory (Braverman, 1974; Lee, 1990). This research approaches the matter from the viewpoint of temporality. Changes in work procedures are traced, described and analysed in terms of temporality. This temporal approach distinguishes this research from other approaches to the matter of information systems and changes in organisational work.

The influence of the newly employed EDI technology is not limited to work procedures and temporal dimensions. Every technology brings in organisational, managerial and social implications when it is employed by an organisation. The objective of this chapter is to seek such implications of KTNET. However the focus of analysis always lies in aspects of temporality. This means that the implications which are traced in this chapter are those which are mediated by the temporal shifts and can be interpreted from the temporal point of view. Before I discuss such organisational and social implications of changes in temporality caused by the new technology, I will summarise changes in the six temporal dimensions of administrative work for export in trading companies and a bank. In the following tables, a plus sign '+' in parentheses means remarkable change in the job concerned, and blank parentheses refers to no change.

B. Analysis of Temporal Dimensions of Export Work

1. Duration

It is quite clear that information technology reduces the duration of tasks as its hype has always insisted. In the field of KTNET, every task's duration has been significantly reduced by EDI. The reduced duration can be attributed to two sources: the replacement of physical delivery of documents with electronic transmission between sites, and the reduction of time in conducting each unit task itself. Duration here refers to the latter. Time consumed for delivery may include 'waiting time' in which documents are waiting before they go through the next step. The reduction in delivery time is not included in the following discussion of duration because it is self-evident and reflected in the changes of cycle, which is another dimension of temporality. For the reduced time for each unit task, the comparison between before and after KTNET is not simple. Once a new system is introduced, unit tasks themselves are subject to radical change. Therefore comparisons of duration of unit tasks are not always possible.

As seen in Table 6-1, duration is affected in all the four procedures examined in the fieldwork. In Daewoo and Sunkyong, the reduction is mainly attributed to the elimination of repetitive data entries and the removal of some paper work. In KEB, duration is reduced due to the elimination of reception, duplicate data entry and some paper work.

Table 6-1. Changes in duration

	trading companies	bank
Export L/C advice	(+) data entry reduced from 3 times to once, and 80% of data already put in by banks	(+) preparation of paper documents eliminated
Export licence	(+) some paper work reduced	(+) receiving visitors and data entry removed
Local L/C	(+) some paper work eliminated	(+) no reception, no duplicate data entry
Negotiation	(+) duplicate data entry removed	not applicable

2. Sequence

Sequence is the order in which activities and tasks take place. A new technology may cause changes in the order in which work is done. As in the duration, however, the comparison of sequences before and after the introduction of a new technology is not easy because it may bring a radically new way of working in which old unit tasks disappear or at least it reduces the number of steps required to complete the whole job.

As Table 6-2 shows, sequence is affected in three jobs: export licence, local L/C and negotiation in the trading companies. Before KTNET, data entry in export licence and local L/C could be performed at any point in the order in which work is done because the processing of an export licence and a local L/C was not incorporated into the internal information systems. After the processing was completed, data produced in the work processes were put into the system. The work itself could be finished without the intervention of the system. Under the new system, the work is incorporated into the system and starts with the data entry into the system. In negotiation, data entry was conducted after the delivery to banks. Now it is performed before it.

Table 6-2. Changes in sequence

	trading companies	banks
Export L/C advice	( ) steps reduced from 6 to 4 by the removal of data entries, yet the basic order remains unchanged	( ) steps reduced from 7 to 3 by the removal of some paper work, yet the basic order remains unchanged
Export licence	(+) data entry fixed at the first step of the whole process	( ) none
Local L/C	(+) data entry fixed at the first step of the whole process	( ) none
Negotiation	(+) data entry for negotiation shifted from after the delivery to banks, to before it.	not applicable

3. Temporal location

Temporal location means when or at which points of time (of day) activities and tasks take place. Tasks are usually not conducted at random points of time. They tend to be carried out at specific points of time customarily or by some technological restraints. We can justifiably say that a new technology system employed by an organisation can shift temporal locations of some activities. It has two possibilities, which are quite opposite; the new technology may release those activities from temporal restraints imposed upon them so far, and on the contrary it may impose such a new restraint on them that they are tied up with newly designated specific points of time.

As seen in Table 6-3, temporal location was affected in most jobs examined in the fieldwork except the negotiation. The two directions of change are found. First, some tasks which have been performed irregularly and sporadically throughout the day are now being processed regularly at fixed times of day. They are export licences in Sunkyong and banks, and local L/C in trading companies. This shift gives workers in charge regularity, which means a possibility to make a schedule at least as far as the task under charge is concerned. Interestingly, the second direction is the opposite. Some tasks which have been conducted at fixed times are now being performed at unspecified times or whenever necessary. They are export L/C advice in trading companies and banks, and export licence in Daewoo. This also raises the possibility of scheduling work especially when tasks can be done at the will of the workers in charge or whenever they are necessary. The shift of export licence procedures in trading companies is noticeable. Before KTNET was implemented, applications for export licence were made irregularly and sporadically. After KTNET is in use in Sunkyong, temporal location for export licence get fixed. In Daewoo where KTNET is developed into an advanced form, they take place whenever workers in charge want them.

Table 6-3. Changes in temporal location

	trading companies	banks
Export L/C advice	(+) fixed collection time ==> collection done when necessary	(+) fixed delivery time ==> delivered at unspecified times and more frequently
Export licence	(+) irregular, sporadic ==> fixed (Sunkyong); fixed ==> whenever necessary (Daewoo)	(+) sporadic, irregular ==> fixed, regular
Local L/C	(+) spreading throughout the whole afternoon (in the assisting team) ==> specific times of the afternoon	(+) late afternoon ==> early afternoon at agreed specific times
Negotiation	( ) no difference	not applicable

4. Deadline

Deadline is the fixed time by which work should be completed. Contrary to general expectation, deadlines are not universal in all tasks. In some tasks - export L/C advice and export licence in banks - no designated time was found which can be called a deadline. Although the principle of 'the faster, the better' was taken for granted for those tasks, there was no deadline specified formally.

The impacts of KTNET on deadline are various as seen in Table 6-4. In negotiation, the existing deadlines remain unchanged. In the processes of export licence in Sunkyong and local L/C in Korea Exchange Bank, a new deadline emerged. In Daewoo, the old rigid deadline in export licence disappeared, so it can be processed at any time whenever necessary. In the process of local L/C in trading companies, rigid deadlines loosened. The loosened deadline was accompanied by some changes in social relations among the workers involved. This will be discussed later in this chapter.

Table 6-4. Changes in deadline

	trading companies	banks
Export L/C advice	* no deadline	* no deadline
Export licence	(+) no deadline ==> three set times arranged as deadline (Sunkyong) rigid deadline ==> no deadline, processed whenever necessary (Daewoo)	* no deadline
Local L/C	(+) deadline loosened	(+) a new deadline, though not serious one
Negotiation	( ) the same deadline remains	not applicable

5. Cycle

Cycle refers to the periodic regularity in which work is completed repeatedly. It was found in the fieldwork that we could distinguish three separate cycles involved with one job. Workers do their duties or activities on the basis of, typically, one day cycle. In each job, there is also a cycle in which an order, for example, an export licence is processed from its application to its issuance. Finally we can find a cyclical period during which orders are accumulated and processed in batch. I call them 'worker cycle', 'order cycle' and 'batch cycle' respectively in the following discussion. They do not always appear altogether in each job. Two or three of them are found in some of the jobs examined in the fieldwork.

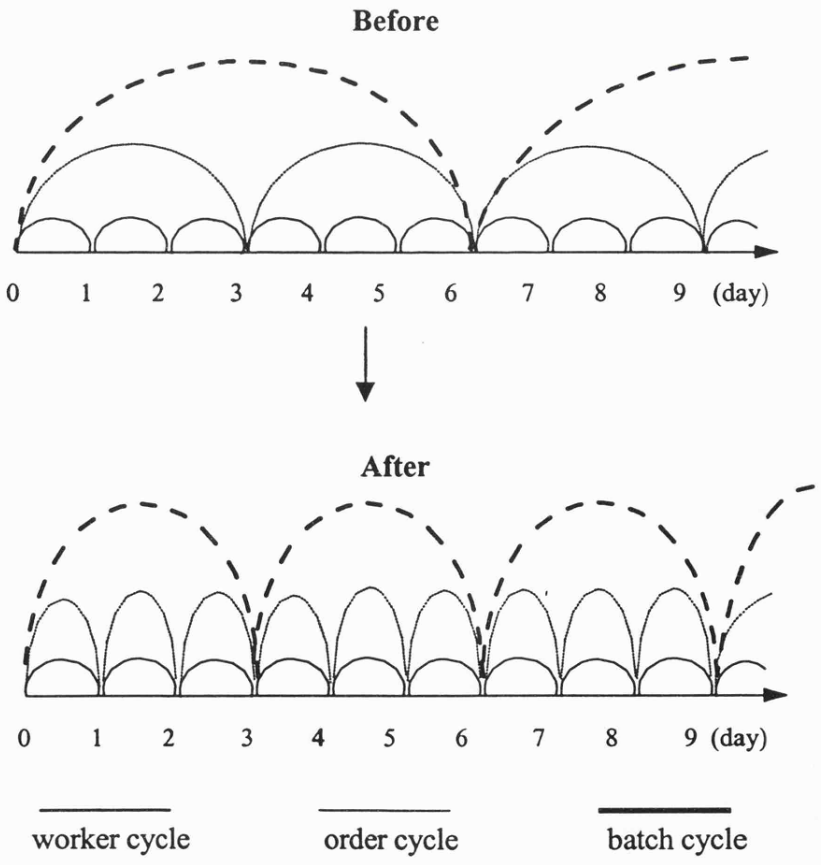
Table 6-5 shows that cycles of all the jobs are affected. All the cycles have been shortened as anticipated by advocates of EDI in particular and information technology in general. Partly as a result of the reduced cycles, cycles in each job are coinciding. For example, under the old system of the export L/C advice, while workers in trading companies repeated the procedures every day, each order completed its journey every seven days. After KTNET, the latter has been reduced to 1-2 days, which means that the worker cycle and the order cycle are coinciding. As described in Figure 6-1, information technology tends to make two or three cycles involved in a specific job converge with each other. The phenomenon that cycles are converging may influence workers' perceptions of work situations in

which they are involved. Such psychological impacts were not studied in the fieldwork.

Table 6-5. Changes in cycle

	trading companies	banks
Export L/C advice	(+) order cycle reduced from 7 days to 1-2 days; as a result order cycle converging with worker cycle	(+) order cycle reduced from half a day to a couple of hours
Export licence	(+) shortened from half a day to 1-2 hours; worker cycle and order cycle converging	(+) shortened
Local L/C	(+) order cycle reduced from two working days to one day; worker cycle and order cycle converging	(+) shortened from one working day to less than half a day
Negotiation	(+) batch cycle shortened	not applicable

Figure 6-1. Converging cycles



6. Rhythm

Rhythm refers to the alternating intensity of being busy. It can be likened to rhythm or dynamics in music. It is closely connected to cycle and deadline. We are not evenly busy while doing something. Just as there are rhythmic alternations of strong and weak stresses in music, we have alternating turns of busy and less busy periods in all the activities we are doing. As shown in Table 6-6, rhythms in the four tasks are not nearly affected by KTNET. Only in local L/C, a little change is found. Because work rhythm is more influenced by temporal conditions determined by external factors surrounding companies than by internal factors such as technological innovations, it is inferred, the impacts of KTNET on rhythm is minimal.

Table 6-6. Changes in rhythm

	trading companies	banks
Export L/C advice	( ) even and flat	( ) even and flat
Export licence	( ) the same rhythm	( ) the same rhythm
Local L/C	(+) evenly, flatly busy ==> stress emerged (assisting team)	(+) late afternoon ==> early afternoon
Negotiation	( ) only a slightly little difference found	not applicable

7. Summary : Changes in temporal dimensions

As shown so far, KTNET has affected the six temporal dimensions of the four major jobs in export administrative work in trading companies and a bank, although not all of the six dimensions and not all the jobs in both sites are affected. As advocates of information technology always insist, duration and cycle are considerably reduced. In the dimension of cycle, not just the reduction but the tendency of converging cycles in each job was found. Another dimension which is remarkably affected by KTNET is the temporal location. Under the new system, some tasks of the four major jobs are performed at different times of day from the previous ones under the old system. Among the tasks of which temporal locations have shifted, some are now conducted at specified times agreed upon by the parties

concerned, and others are at unspecified times when it is necessary to perform them. Where deadlines exist in completing the jobs, they are also affected. Although it is early to conclude, a tendency is observed that the more advanced information systems are employed, the less rigid deadlines become. Sequence is modestly affected. The integration of the procedures into the internal information systems requires the place shift of data entry to the first step in the work order. Rhythm is the least affected dimension.

The changes in temporal dimensions are not limited to temporal changes themselves in organisational work. They may have various implications for the organisation which adopts the new system and therefore undergoes those temporal changes. In other words, a new (technological) system is likely to cause organisational, managerial and social transformations. Among them, some are more attributed to temporal changes than to other changes. They require separate analysis and interpretation which address temporality. The following section deals with them.

C. Implications of Changes in Temporality

In Chapter 3, the five research issues were raised as regards social and organisational implications of changes in temporal order. They were examined empirically on the site of KTNET. This section discusses and analyses social and organisational implications of temporal changes caused by KTNET.

1. Information technology and flexibility in work

Failla and Bagnara (1992) state that "(I)ncreasingly, the organization of work is becoming less rigidly defined by highly rationalized time patterns", especially in the case of professional, knowledge-based work in offices as information technology support increases. Although they did not clarify in what sense and to what extent 'professional' and 'knowledge-based' the work is, and what kinds of jobs belong to it when they mentioned 'professional', they thought that the potential of information technology to make work flexible could be better realised in professional work than in clerical work. The export procedures to which

EDI technology was applied in this research is clerical. The jobs to deal with them cannot be described as 'professional' and 'knowledge-based' in any case. Most of the workers affected by KTNET are female high school graduates. Unlike Failla and Bagnara, therefore, I show that information technologies make the temporal order of work flexible regardless of the nature of work, whether it is professional or clerical.

In the job of export letters of credit advice, the bank delivered them at fixed times of day, in the morning and 2 p.m., and the trading companies collected them correspondingly at relatively fixed times. KTNET made a difference to this practice. The bank transmits export letters of credit electronically at unspecified times when a reasonable number of L/Cs has accumulated. It takes place 4-6 times a day at intervals of about two hours. In the trading companies, the workers in charge can retrieve L/Cs at their terminals regularly or whenever they want to check whether a specific L/C has arrived.

In the job of export licence, we can find a more complex, but interesting, trend in which the flexibility increases as the system adopted advances. In Sunkyong where assisting teams take responsibility for transmitting EDI messages, fixed times for transmission are arranged between Sunkyong and the banks involved. Previously E/L applications came to the assisting teams irregularly and then to the banks although there was a rule of thumb about when to arrive. E/L applications which used to be delivered relatively irregularly now arrive at fixed times. Here the word 'fixed' must not be interpreted literally. At a glance, the words 'flexible' and 'fixed' are opposite to each other. Suppose a task happens irregularly and sporadically. Then the worker in charge cannot get properly engaged in other tasks because he is tied up with that task and always remains ready to do it. If the task takes place on a regular basis, namely at fixed times, he can think of a schedule and deal properly with the task as well as other tasks. We can say that he is now more flexible in organising his time. Therefore we need to consider 'flexibility' in terms of the organisation of workers' time, not in terms of individual dimensions of temporal order. In this way fixed temporal locations may mean 'flexible' for the workers in charge, and the KTNET in Sunkyong increased

the flexibility in processing E/Ls. The same is true of sequence shifts in export licence and local L/C. The data entries into MIS in both jobs were often postponed, and could be conducted at any step of the processes, usually when a reasonable number of orders gathered and when workers in charge were less busy. However the introduction of KTNET has fixed the place of data entry at the beginning of the whole process. We can interpret this fix as 'being less flexible' from the viewpoint of the single dimension of sequence. However when we consider it from the viewpoint of the whole job, that is, in terms of workers' organisation of time, then fixed data entry is regarded as inevitable for the integration of the job into the internal MIS system, which will contribute ultimately to increased flexibility.

Daewoo has implemented a more advanced form of EDI in which the E/L team is removed from the main process and workers in business departments transmit their E/L messages via KTNET directly to the banks. They can send E/L application messages at any time when E/Ls are necessary. The workers in charge of E/L in Daewoo seem to be more flexible in organising their work time than those in Sunkyong. Corresponding shifts in temporal location happened on the bank's side. Transactions which used to be made irregularly when customers visited with their applications now take place at fixed times and at a more regular basis, at least in transactions with the trading companies using KTNET. This change slightly increases the flexibility of tellers' work in branches.

We can also observe a similar shift in the dimension of deadline. In Sunkyong where there was no deadline as far as E/Ls are concerned, three deadlines were created after KTNET was implemented. Daewoo had rigid deadlines for E/L before KTNET. Deadlines do not exist any longer in Daewoo because the workers in charge now can transmit E/L application messages whenever E/Ls are necessary. The removal of deadlines means increased flexibility for the workers in charge. While similar shifts in temporal location and deadlines are found in the process of local L/C, the negotiation process is least affected in terms of the flexibility which is expressed by changes in temporal location and deadline.

From the observations described above, I conclude with qualification that KTNET tends to increase the flexibility in some of the export administrative work examined in this research. Old rigid time-frames are being replaced by more flexible time patterns. Workers involved in that work have become flexible in organising their work time due to KTNET.

2. Internal and external flexibility

In Chapter 3, internal and external flexibilities were distinguished. Internal flexibility is concerned with flexibility in work processes themselves and can be easily grasped in terms of some of the six dimensions of temporal order. What was described in the previous section is entirely concerned with the internal flexibility. However, impacts of information technology on work processes are not limited to the processes themselves. They reach through the departmental horizon up to the whole organisation and beyond where various levels and patterns of flexibility can be thought of. For example, external flexibility ranges from the ability to adapt to changing environments in the broadest sense, to decentralise the production activity and to use human resources flexibly in terms of time and space (Failla and Bagnara, 1992, p. 672), down to the ability to work smoothly without bottlenecks across functional units within the confines of the organisation.

Just as technological flexibility does not guarantee organisational flexibility (Lucas and Olson, 1994), internal flexibility does not necessarily bring external flexibility with it. Although constant efforts have been made throughout the fieldwork and the following analysis to find occasions which can support the argument, any occasion where external flexibility is concerned was not found among the four jobs investigated. Hindsight suggests that the result is understandable when we take into account the scope of the fieldwork where the attention, focused in depth but limited in scope, was paid only to work procedures and practices in offices of one or two departments. Departmental relations and further considerations were wide of the focus, and beyond the scope, of the fieldwork.

However it is not that no insight was gained about the relationship between internal and external flexibilities in the fieldwork. An occasion was found in which the potential of internal flexibility was not fully realised because of the rigid time patterns of an adjacent department in the whole work chain of export processes. The problem had not emerged as a result of KTNET, but already existed before KTNET. In the negotiation process, the three different cycles are found to exist: worker cycle, order cycle and batch cycle. Workers in charge repeat the same activities every day. Each negotiation order gets signed and transferred to the trade accounting department in 3-4 days from the day it arrives in the foreign exchange department for negotiation. However, this is so only in principle. Negotiation bills are not delivered to the accounting department on a daily basis. Before KTNET they were dealt with on a ten-day or longer basis, and the majority of them usually remained in the bill workers' desks until the deadline day set by the trading accounting department came. As described in Chapter 5, the workers in charge of the negotiation bills were so busy that they were not able to process them properly on a daily basis. More importantly, however, the trade accounting department itself did not want to receive them every day. The accounting department runs on a monthly basis. The main duty of the accounting department is to produce monthly reports and an annual report on financial accounts. All the activities of the accounting department are organised based on this monthly cycle, and rigid deadlines are set around the last days of each month. As for the workers in charge of the negotiation bills, what is important is to keep to these deadlines, not to observe regulations which stipulate the 3-day processing and which exist only as recommendations and in principle. Therefore there was a big gap between order cycle and batch cycle, and a great deal of work concentrated toward the deadline, the last days of each month. This phenomenon is well described in terms of the temporal dimension of cycle by Schriber (1986), when she states;

> (T)he temporally bounded task cycle framework can be extended to the scope of the entire organization. Functional work units within organizations might each have their own rhythm based on the mix of internal and external connectedness, related goals, and defined responsibility. (...) On the other hand, the accounting department of the same firm is constrained to a greater extent by artificial cycles. Among these are the necessity to report earnings and pay taxes on a cycle dictated by the government. Unfortunately, the accounting department is also

> constrained by the cycles of other departments in its organization, such as the forestry department. One can imagine that the accounting department experiences work overload when the meshing of various differentially determined cycles converge to exceed the temporal resources available (p. 33).

The introduction of KTNET provided the possibility to fill the gap and evenly distribute workload across the month. Actually KTNET shortened the batch cycle to about seven days and alleviated the extent of job concentration on deadline days. However, it is far from what would be expected from the new technology. In this case, the rigid monthly cycle of the accounting department restrains the potential which KTNET has for the internal flexibility.

This case raises the issue of integration of EDI with internal MIS applications within an organisation as much as it does the issue of discordance of internal and external flexibilities. The integration of EDI into other applications is essential for its successful implementation (Bergeron and Raymond, 1992). Because the issue of integration is beyond the scope of this research on temporal implications of information technology, the issues is not addressed further here.

In summary, in Chapter 3, I distinguished between internal and external flexibilities and stated that the internal flexibility would not guarantee the external flexibility. I also anticipated that I could find some occasions of such discordance in the fieldwork. Although we did not find an occasion which clearly supported the argument, one occasion deserved our attention, where the rigid temporal pattern of an adjacent department in the work process restrained the full realisation of internal flexibility in work procedures. The case does not demonstrate the argument of discordant internal and external flexibilities, but provides a point of departure for further research.

3. Monochronicity and polychronicity

a. The two temporal cultures and information technology

As described in Chapter 1, Hall (1983) distinguished between polychronic and monochronic cultures, which are the two different ways in which societies organise time in their everyday life, especially in working life. Here the words

'monochronic' and 'polychronic' should be understood in a relative sense. It is absolutely impossible to do several things at a single moment. Although, for example, we can get involved in several projects during a given period of time, e.g. a week, we can perform only a single activity required in each project during a shorter period of time such as a second, ten minutes, one hour, a day and so on. Although it is difficult to accept his whole argument on cultural differences among countries along the line between monochronicity and polychronicity because of his broad generalisation, the distinction itself provides a useful insight for those who intend to study temporal aspects of organisations. When it comes to the nature of the two cultures, he emphasises that monochronic time is arbitrary and learned.

> Because it is so thoroughly learned and so thoroughly integrated into our culture, it is treated as though it were the only natural and logical way of organizing life. Yet, it is not inherent in man's biological rhythms or his creative drives, nor is it existential in nature (Hall, 1983, p. 45).

It is simply one aspect of socialisation. At the same time he argues that "without schedules or something similar to the M-time (monochronic - by this author) system, it is doubtful that our industrial civilization could have developed as it has." This corresponds to Mumford's (1934) and Thompson's (1967) arguments on clocks and the development of the modern industrial age.

Schein (1992) applied the distinction to organisational settings at a conceptual level. Because monochronic time is more efficient to control and coordinate human behaviour, he suggests, it is well suited to the management of large systems. It is taken for granted in most organisations as the only way to get things done efficiently. On the other hand, polychronic time is more effective to build relationships and to solve complex problems. It is therefore considered more suitable for the early stages of an organisation, for smaller systems and for organisations where one gifted person is the central point of coordination.

The application of the distinction to organisational settings is a sensible one, but Schein's matching between the two temporal cultures and their suitable organisation types has a weakness in that he does not take into account the role of information technologies which affect organisations in a variety of ways these days. Although Schein's characterisation might be right for the past when

information technologies did not play a significant role in managing organisations, now information technologies are imposing an increasingly new dimension on such characterisation. In addition, Hall and Schein, who were trained in anthropology and organisation study, do not seem to have attempted to judge which is the better way of organising time. Regardless of their intention, however, their discussions about the two temporal cultures give readers the impression that monochronic cultures are superior to polychronic cultures, especially in terms of productivity in organisational work. The fieldwork conducted in the site of KTNET, however, presents a view in which information technologies allow a different interpretation of the distinction between monochronicity and polychronicity from the ones that Hall and Schein made.

b. Polychronic way of working realised on the site of KTNET

In the E/L procedures before KTNET in Sunkyong, the clerk in the assisting team used to receive applications from several business teams irregularly and sporadically throughout the day. Because it was usually considered that E/L applications had to be processed on the day, she dealt with each application immediately as it arrived. She was so often interrupted by the E/L applications that she was not able to concentrate properly on something other than E/L. She worked in a monochronic way in which she was able to perform only E/L processing in most working hours. The introduction of KTNET has brought about a significant change in this respect. KTNET has allowed the assisting team to establish the three deadline times by which business teams should submit E/L applications in order to be transmitted to, and returned from banks on the day. The deadlines are 10:40, 13:40 and 15:00. The worker in charge of E/L in the assisting team can now deal with other jobs while waiting until the deadlines come. The major informant in charge of KTNET agreed that KTNET applied to E/L procedures enabled E/L workers to utilise their time in a polychronic way, which he expressed as 'multitasking' in computer terminology.

The shift to polychronic time is also observed in banks. After KTNET, workers in charge of E/L in trading companies do not visit banks for applications. Instead they transmit applications via EDI and receive approved E/Ls in electronic

form. What is good for tellers in bank branches is that they do not have to receive in person visitors for E/L business. Now their work time is not interrupted by irregular and unexpected visits. Tellers simply check at their terminals E/L applications received through KTNET at the agreed times with the trading companies or at a regular interval. Outside the agreed times, they can deal with other businesses properly without being interrupted by irregular and sporadic E/L applications. They can now utilise their time 'relatively' better in a polychronic way than before KTNET. The word 'relatively' is inserted for two reasons. First, tellers in charge of E/L in branches usually take responsibility for several tasks. Therefore the impacts of the changes in E/L procedures on tellers' working life are not so strong as those in E/L workers in trading companies who are exclusively responsible for E/L. Second, the advantages of KTNET are not fully realised in bank branches as in the assisting team in Sunkyong because banks have a wide range of customer companies, among which many small and medium-sized companies do not use KTNET yet. Therefore bank branches have to process E/L in both ways, old and new. The same phenomenon of increased polychronicity also happened in local L/C procedures in bank branches.

c. The contrast with Barley's study

This increased polychronicity is contrasted with the result of Barley's study (1988), which was mentioned in Chapter 1. In a study of the introduction of computerised equipment into radiology departments in hospitals, Barley discovered that the new computer-based equipment increased the monochronicity of radiologists' work by restructuring duration, sequence, temporal location and rate of recurrence of events in the radiologists' working day. It also enhanced the symmetry of temporal organisation between radiologists' and technicians' work. Barley's work shows the exact opposite of what the KTNET case reveals. While in Barley's work the computer-based technology increases the monochronicity of radiologists' work, the EDI in KTNET, on the contrary, enhances the polychronicity of E/L workers' work in the assisting department.

However, further scrutiny of the two studies reveals that their results cannot be regarded as seriously contradictory. Before we go further, it is

necessary to point out something important to avoid confusion which will emerge as discussions advance. It was noted in the beginning of this section that 'monochronic' and 'polychronic' should be understood in a relative sense. On top of that, monochronic and polychronic times are not mutually exclusive to each other. They are mixed in our ordinary life and our way of working. While we often eat lunch reading a newspaper or having conversations, we are likely to allocate a specific amount of time exclusively for study. In workplaces, while we sometimes proceed with a couple of projects during the same period, and respond to urgent callings from a certain project immediately when a problem arises, we allocate a specific time slot to each project, for example, Monday for Project A, Tuesday for Project B and so on.

d. Two domains of temporal behaviour

Furthermore we need to distinguish between the two separate, though closely connected, domains in workplaces to which discussions about monochronic and polychronic times can be meaningfully applied. The one is the way in which tasks and events occur in a temporal sense. We call it 'temporal behaviour of events and tasks'. While some events take place in an unexpected temporal way, i.e. irregularly, sporadically and unevenly, others come in an organised temporal way, i.e. regularly, in sequence and one by one. The former is polychronic, the latter monochronic.

The other domain is how workers organise their time to deal with tasks and events. It is concerned with the way of working and named 'temporal behaviour of workers'. Some may deal with tasks and events spontaneously as they arise and may perform several things in any order during a given period of time whether they occur regularly or not. This is a polychronic way. Others may deal with events regularly at specified times and conduct one thing at a time, following the temporal order in which they occur. This is monochronic. By intersecting the two domains, we can make a matrix of temporal behaviour in a work environment as in Figure 6-2, from which we can think of the following four possibilities.

Figure 6-2. Matrix by the two domains of temporality

Temporal behaviour of workers	Temporal behaviour of events and tasks: Monochronic	Temporal behaviour of events and tasks: Polychronic
Monochronic	I	III
Polychronic	II	IV

Possibility I: Events take place in a monochronic way, that is, regularly, in sequence and at specific times. Workers in charge also operate in a monochronic way; they normally perform one task at a time. If a proper arrangement is made in order to coordinate both temporality, things will go smoothly.

Possibility II: Events take place in a monochronic way, whereas workers in charge operate in a polychronic way. They can cope with tasks spontaneously as they arise. It is expected that tasks are completed without difficulties.

Possibility III: Events happen in a polychronic way, namely irregularly and sporadically throughout a working day. However, workers in charge operate in a monochronic way. They cannot cope with the tasks properly, which might lead to a conflict among workers or departments. The conflict can be alleviated or removed in two ways; whether temporal characteristics of events are transformed so that they take place in a monochronic way or workers are trained so that they can cope with tasks in a polychronic way.

Possibility IV: Events take place in a polychronic way and workers operate in the same way. They can deal with tasks spontaneously as they arise and perform several tasks at a time. In this case, tasks are expected to be completed properly and timely without a separate coordinative arrangement.

Among the four possibilities above, possibility III draws attention because it produces a conflict which should be sorted out in organisational measures. This was mentioned and well described by Schein (1992, p. 114). According to him, polychronically driven work may frustrate the person who is working monochronically. He takes an example of the interaction between an air traffic controller (polychronic) and the pilot of a single aircraft waiting for landing clearance (monochronic).

Returning to the E/L procedures, before KTNET, applications for E/Ls arrived irregularly in the assisting team, that is, whenever they were necessary for business teams. They occurred polychronically. However the E/L workers in the assisting team operated in a monochronic way. A discrepancy existed between them. It lead to the monochronic way of organising work time in terms of workers' daily schedule. To put it another way, because E/L applications occurred irregularly, the E/L clerks' work tempo was often interrupted by them, and they were not able to deal with other tasks properly. As a result, they were not able to make a schedule for daily activities. During a given period of time, e.g. a working day, what they could perform properly was E/L procedures only. Their organisation of work time on the horizon of the daily schedule was monochronic.

KTNET has made a difference to this scene. E/L applications no longer come irregularly, but at specified times. KTNET has enabled the assisting team to fix those times for E/L transmission. Some specific slots of time are allocated exclusively for them in E/L workers' work time. It is monochronic. Now there is no discrepancy between the way events take place and the way to deal with them. Workers operating in a monochronic way can process the tasks occurring in a monochronic way without any difficulty. From the viewpoint of the daily

schedule, they know the exact times for their major duty, e.g. the E/L processing, and can make a plan for the day. Consequently they can deal with other tasks properly during a given period of time, e.g. a working day. In other words, their organisation of daily work time has become polychronic. Figure 6-3 shows the model of the shift described above.

Barley's study can be modelled in a similar way, though with a few differences (Figure 6-4). This time the temporal ways the two professional groups - radiologists and technicians - operate are compared. Unlike the E/L workers in the KTNET case, the two groups organise their work time as the way tasks and events arise. Radiologists work polychronically as their tasks occur in a polychronic way; technicians operate monochronically as their tasks occur in a monochronic way. Radiologists in the departments using old X-rays are frequently called by technicians who seek the assistance of the radiologist on duty. They are also visited by physicians and colleagues who require his consultation. The flow of a radiologist's day is fragmented into lots of discrete events with relatively short duration, unpredictable sequence, vaguely estimated temporal location and irregular rate. Accordingly it is difficult for them to deal with one event at a time, and therefore they operate in a polychronic way. On the other hand, technicians' work proceeds exactly as scheduled by a daily timetable of patient appointments, and they work in a monochronic way.

Figure 6-3. Temporal harmony in the two domains of KTNET

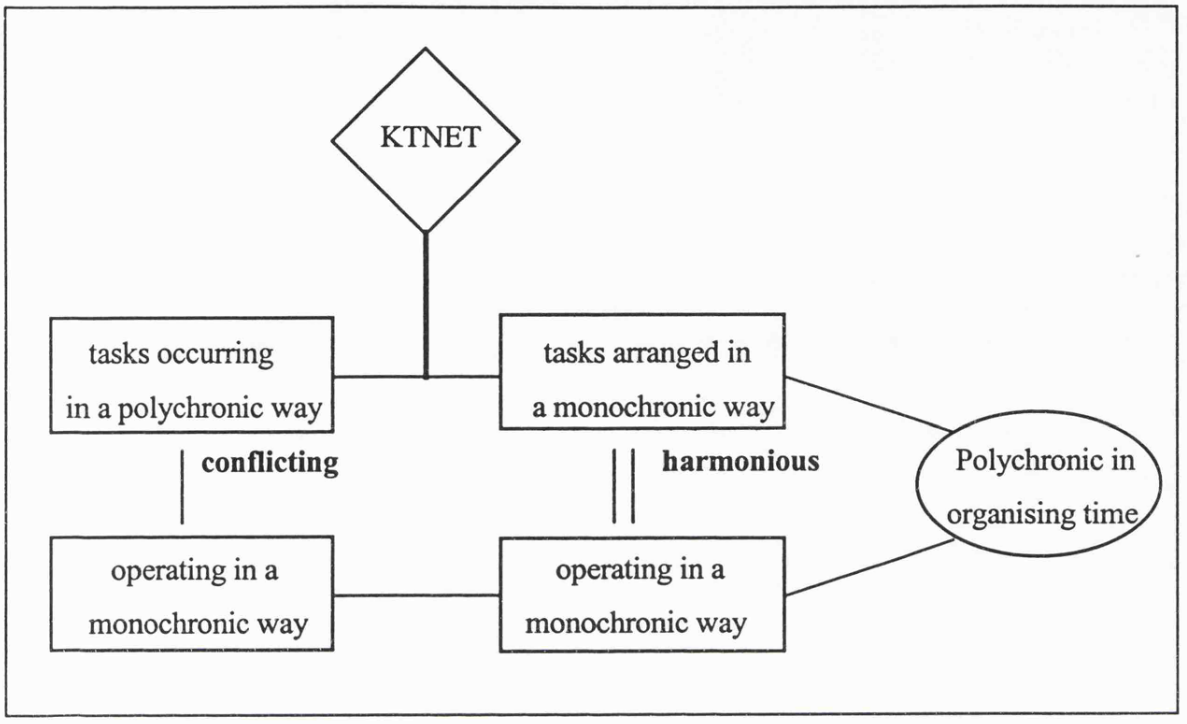
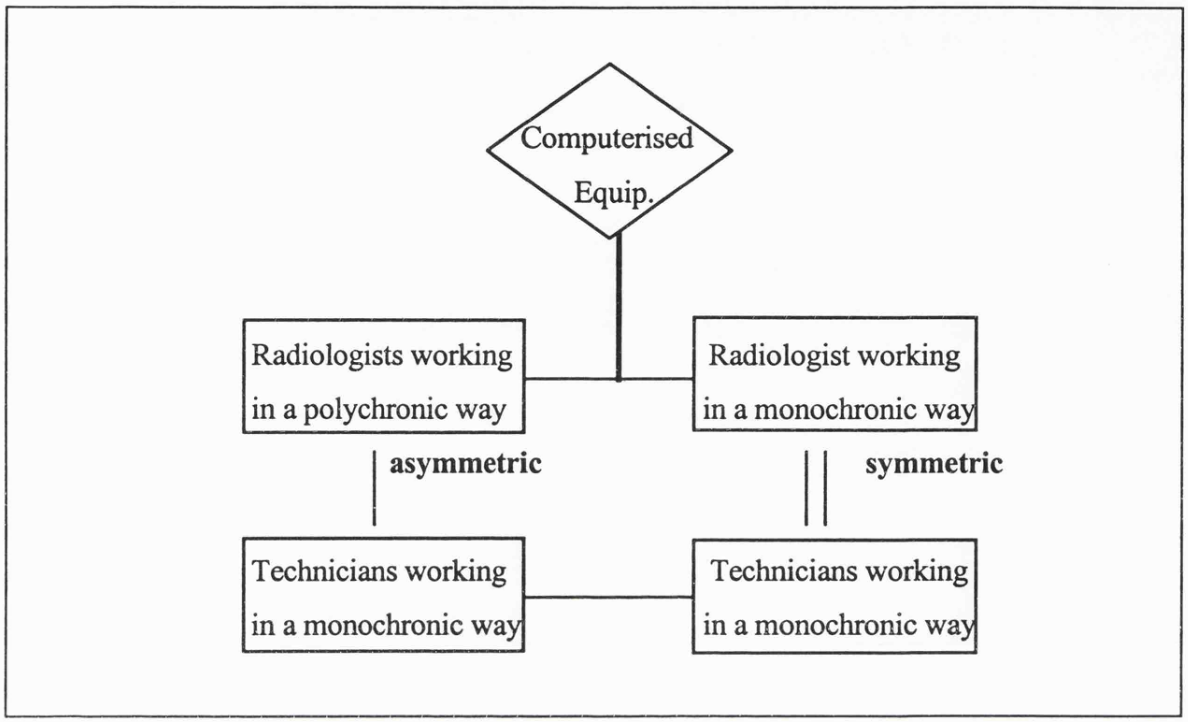


Figure 6-4. Temporal symmetry in radiology departments



In the work world of radiologists and technicians, such conflict as observed in the work world of the E/L workers is not found between the temporal way in which tasks and events arise on the one hand, and the other way in which workers organise their time to deal with tasks and events. Instead the two groups collide in their workplace because they live in different worlds of temporality, in other words, in temporal asymmetry (Barley, 1988, pp. 126-127; Zerubavel, 1981, p. 64). When a technician needs a radiologist, he often has to look around for the radiologist on duty. Even after he finds the radiologist, he often waits because the radiologist could be on the phone, talking with other doctors or reading films. Facing such occasions, technicians feel annoyed and are discontent with their relationship with radiologists.

The computer-based equipment such as CT (computerised tomography), magnetic resonance and ultrasound, has changed this situation. For example, the radiologists assigned to CT duty consult more or less exclusively with physicians who ordered CT or ultrasound scanning. CT duty limited the scope of the radiologists' responsibilities, distanced them from other technologies, and transformed the temporal order of radiologists' work; duration became lengthened and rate slowed down. As the structural aspects of temporality change, the flow of radiologists' daily activities has become closely tied to the ultrasound machine's schedule by which the temporal organisation of the CT technicians' experience is shaped. A radiologist monitors the day's schedule and the progress of the technicians' work, and thereby he could estimate the sequence, temporal location and rate of recurrence of his primary duties. Now the radiologists on CT duty can operate based on the schedule, i.e. in a monochronic way. As described so far, the new technology has brought about the alterations in the structure of the radiologist's day in the direction of increasing monochronicity, and thereby enhanced the degree of symmetry between the temporal organisations of radiologists' and technologists' work.

e. Temporal symmetry and information technology

To sum up, the new EDI technology increases the polychronicity of some workers in organising daily work time in the case of KTNET. The new computer-

based equipment in radiology departments raised the monochronicity of radiologists' work in Barley's work (1988). At a glance, the two results are contradictory. However scrutiny shows that there is something common between the two. In both cases, the new information technologies performed a function to make a symmetry between conflicting temporalities, although temporalities exist at different levels. In the former, KTNET helps to harmonise between the way tasks and events occur and the way workers organise their time to deal with them. In the latter, the computerised equipment contributed to making a temporal symmetry between radiologists' and technicians' work worlds.

From the two results described so far, I show that information technologies perform the function to create a temporal symmetry, but only in a tentative sense. It is thought to be hasty at this stage of research to generalise the result into information technologies as a whole. There are several limitations which restrict the extension of the result. First of all, the information technologies examined in the two studies are different in nature. While Barley dealt with computer-based radiological technologies, KTNET is an application of electronic data interchange, a type of interorganisational information system. Although the radiology equipment in Barley's work is based on computers, it is closer to manufacturing technology than administrative and managerial technology which is more relevant when we refer to information systems. In addition, organisations where the case studies were conducted are fundamentally different; hospitals are characterised by complex composition of various professions, and the composition of trading companies is relatively homogeneous. Different professions - medical doctors and technicians on the one hand, and office workers - also may make a difference.

At this stage of research, it is difficult to decide which temporality, monochronicity or polychronicity, information technology facilitates, or whether information technology will always create temporal symmetry. More research on the relationship of time and information technology is required to generalise or make a contingent theory.

4. Changes in social relations

In the previous section, Barley's work was described in detail. According to the literature review in Chapter 2, his study is the only one that investigates empirically how technology affects temporality at work. However it is not all that he intended to show by his study. His ultimate purpose was to explain how technology affects social relations between groups (professionals in his work) at work places. His contribution lies in the fact that he approached that question from the viewpoint of temporality, which has never been attempted so far by any other social scientists. In the radiology departments, the temporal symmetry made by the new computer-based equipment contributed to reducing conflict between radiologists and technicians, and changing the social relationships between them. The new relationships are marked by greater equanimity and less conflict between the two professional groups than were the old relationships under old technology systems (x-ray). For Barley, however, the temporal symmetry is just one of many factors which influence changing relationships. He attributed the shifts in social relationships in part to the fact that "new modalities initially level status differences based on distributions of knowledge" (Barley, 1988, p. 136; 1986). What he suggests in his study is that various aspects of the social order surrounding the new technologies contribute to qualitatively different forms of interaction. The temporality of work is an important one among them.

In the example of KTNET an occasion is observed in which changes in social relations are triggered by the new EDI system. As described in Chapter 5, the rigid deadline in the procedures of local L/C in the trading companies became less rigid. Under the manual system, business teams had to submit local L/C applications to the assisting team before 11 o'clock. Because there was much work to do on the side of the assisting team after it received the applications, it was important for business teams to meet the deadline. The local L/C workers in the assisting team repeatedly urged them to meet deadlines, which was a constant source of uneasiness between the two departments. The implementation of KTNET has reduced substantially the workload of the assisting team after they receive the applications electronically. Therefore the 11 o'clock deadline is not as rigid as it was. For example, even when some applications arrive after 11 a.m., the

workers in the assisting team can process them properly on the same working day. As a result, the workers in charge in the assisting team do not press business teams to meet the deadline as they did, which means that a source of conflict between them disappeared. "My position toward business teams has changed from urging to helping" (p. 161 in the text), said a clerk in the assisting team.

In summary, the less rigid deadline in the procedures of local L/C has changed the social relations between the assisting team and business teams. It affects inter-personal or inter-departmental interaction. When the deadline was rigid, workers in business teams and in the assisting team were hostile to each other. Often when workers in business teams lagged behind the deadline, the assisting team urged them to meet the deadline. Now they are not hostile to each other, but cooperative. The workers in the assisting team try to help rather than urge. It is difficult to insist at this stage of research that changes in temporality always bring such changes in social relations among the parties concerned. Similar occasions were not found involving changing social relations among groups or departments in the three other areas investigated, namely export L/C advice, E/L and negotiation. The issue of temporality and social relationships also requires further empirical research to generate propositions with rich implications.

5. Temporal arrangements between organisations

KTNET is an EDI application. One of the most distinguishing features of EDI is that it is typically used between organisations, although it can be used within an organisation which has offices, branches and factories at different sites. EDI is a type of interorganisational information systems (IOS). As such EDI has raised interorganisational issues, which have to be explored in information systems research. Throughout the case study, attempts have been made to read interorganisational implications in terms of temporality. It is revealed that the implementation of KTNET has included new arrangements of temporality between transactional partners. Once a new system was employed in the export procedures between trading companies and banks, the two parties had to make a new temporal arrangement, for example, of temporal location, i.e., when transactions would take place between them under the new system.

In the processing of E/L applications, there was no agreement about the times when transactions took place between trading companies and banks, although a rule of thumb existed. After KTNET was implemented, Sunkyong with the banks involved set the times for transmitting E/L applications three times a day; 10:40, 13:40, and 15:00. Banks return the E/Ls issued at 12:00, 15:00, and 16:30 respectively as agreed. In Daewoo where a sophisticated system is in use, workers in business departments transmit E/L applications directly to banks, without the intermediary of the assisting team, via KTNET whenever they want. Here the banks made an agreement with Daewoo that tellers would check and respond every hour. In the local L/C procedures, the transmission now takes place between 11:00-13:00 in Sunkyong and 13:00-14:00 in Daewoo as agreed upon with the banks concerned. The local L/Cs issued return to the company around at 17:00 in Sunkyong and at 15:00 in Daewoo. From the observations described above, I show that the implementation of interorganisational information systems such as EDI facilitates a temporal adjustment between the parties (organisations) concerned.

Chapter 7
Conclusion

A. Summary

1. The significance of the research

There has been much discussion about an information society in the social sciences such as sociology (Bell, 1985; Lyon, 1986; Miles, 1988), economics (Porat, 1977) and futurology (Masuda, 1981, 1990) as well as in the public media since computers began to partake in almost aspect of contemporary society. Many sociologists have been interested in social change caused by information technology since the classic work of Bell (1974). They have used various terms to describe changes which are taking place in the contemporary society: post-industrial society, information society, information economy, and so on. They have tried to establish a theory about social changes caused by information technology. However, their descriptions are often too general, journalistic and, at best, concerned with forecasts of the future. In brief, they see the phenomena with a bird's-eye view so that they only draw a vague picture of the forest and lose details such as how a specific aspect of our life as working individuals is being (re)shaped by the new information technologies.

Compared with studies in sociology, research in the information systems area comes close to the forest and focuses on the trees. However, most of the research is oriented more to practical applications than to fundamental issues such as the information society. Such discussion on the information society is added at the end of most MIS textbooks only to show that authors are not blind to those (significant) social implications of information technology. Although there are several works on social implications of information technology in organisations within the discipline of information systems (Kling, 1980, 1982, 1991; Hirschheim, 1985; Orlikowski, 1988, 1991; Walsham, 1993), the mainstream of the research is on practical design, development and implementation of a specific information system in business organisations. This is due partly to the short history of information systems as an independent discipline

and partly to its inevitable focus - determined by its birth as a child of the marriage of computer sciences and management studies - on applications of information technology in business organisations as shown in the acronym of MIS (management information systems). In summary, research in information systems has been relatively successful for practical investigations of information technologies in organisational backgrounds, i.e. to see trees. Yet it is not suitable to confront fundamental issues which information technology has been raising all the time in the contemporary society, such as how information technology is transforming our way of life, especially our working life.

This research on time and information technology came out of an attempt to fill the gap formed by the two defects: the lack of detailed research on social transformation by the new information technologies on the side of social sciences, and the incapability of information systems research to deal with essential problems which information society requires us to address. Stamper (1988) provided an initial point for the research as described in Chapter 1. He presents a method, called evaluation framing, by which we can analyse cultural impacts of information systems on organisations which have adopted the systems. Stamper's concept of culture, borrowed from Hall's taxonomy of cultural patterns of behaviour (1959), consists of ten elements. Investigation along the ten streams of cultural messages shortly revealed that among them, space and time were the most important elements of culture. Hall dedicated himself to writing separate books on cultural aspects of space (1966) and time (1983). While the study on structural (re)configuration of space by information technology is a well established area of geography (Castells, 1989), the relationship between time and information technology has been rarely studied in social sciences as well as information systems research. Then it did not take long for this finding to lead the author to the theme of this research, namely how information technology affects temporality of work in organisational settings.

Returning to the forest analogy, investigating temporal aspects of a small work group which was conducted in this research can be likened to examining a leaf of a tree in the forest. The leaf has its own characteristics which distinguish it from other leaves. At the same time, it shares common properties with other leaves

in the tree depending on its species on the one hand, and properties determined by environmental factors such as the weather, soil, water, etc. surrounding the forest on the other. Therefore the examination of a leaf can provide us with useful clues - though basic - on some fundamental aspects of the forest itself and the surrounding ecosystem. Likewise, the study of temporal impacts of a new information technology in a work situation of an organisation can give us some knowledge of a temporal mechanism by which the organisation operates. We can apply the knowledge to other work situations and other organisations, and extend it to make out the temporality of the whole society in which organisations are located and information technologies are overwhelmingly dominating. Observation of temporal aspects in a small work group looks like tracing trivial things. As much as they look trivial, however, it means they are basic aspects of our working life.

2. The common view of time and IT and a new analytical approach

The following figures show the logical structure of the whole thesis. Figure 7-1 presents the common view of the relationship between time and information technologies, and reveals what is missing. It is generally accepted or taken for granted that information technologies speed up business processes and save a lot of time. However, the mechanism through which information technologies increase the speed of business processes and reduce the time required to complete them remains obscure. Furthermore, we are completely ignorant of what happens beyond speeding-up and time-saving. This research has attempted to fill the gaps formed by the two questions, which have not been answered, or even been raised properly previously.

The diagram in Figure 7-2 presents answers to the questions above resulting from this research, which I hope will be improved and made more sophisticated by future research. The first box shows the six dimensions of temporal order. They are derived from previous research in psychology, sociology and organisational studies and are reorganised to profile temporal shifts in organisational work. The combined effects of the changes in the six dimensions tend to increase flexibility. The increased flexibility helps to create temporal symmetry, which is represented in terms of the monochronicity and polychronicity

of temporal behaviours of events/tasks and workers. These changes in temporality carry with them interpretive aspects whose managerial, organisational and social implications should be decoded for a richer understanding of the relationship between time and information technologies. The crossed dotted curves mean that external and interpretive aspects of temporality partly overlap and that it is difficult clearly to distinguish between them.

Figure 7-1. The common view of time and IT and what is missing

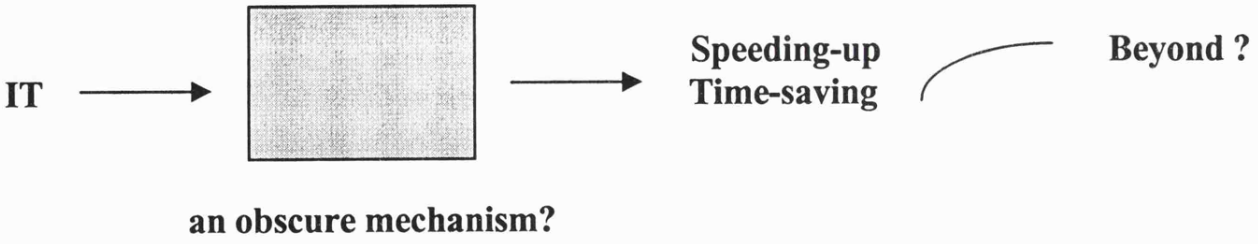
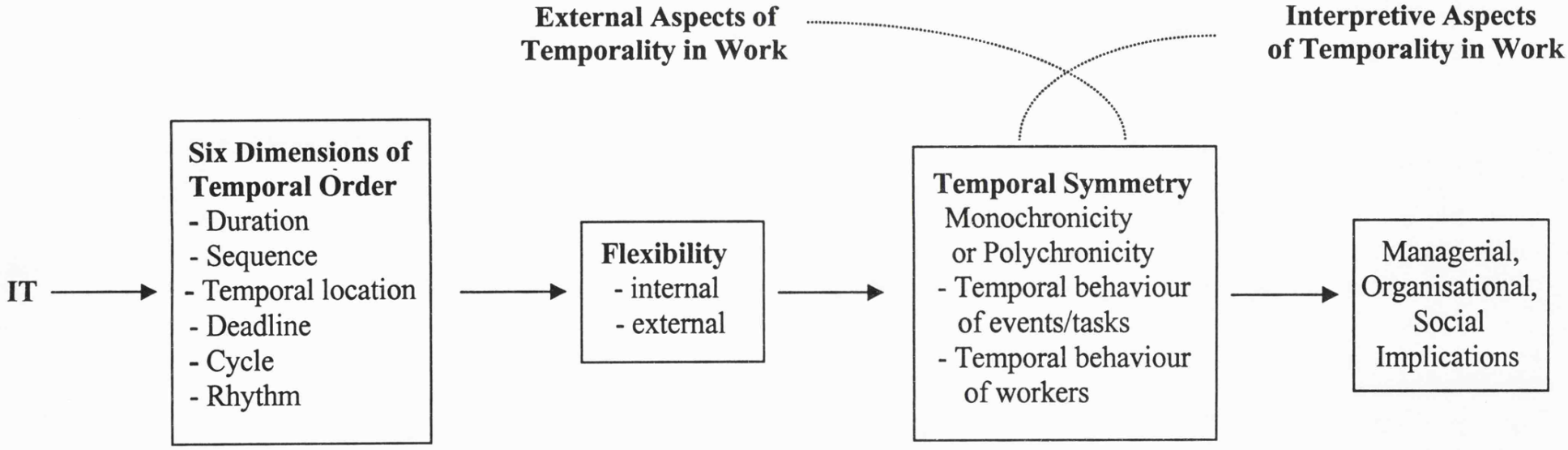


Figure 7-2. A new analytical approach to explain how IS affect temporality



3. Summary by chapter

Chapter 1 started with a sociological concept; time is socially constructed. It is argued that time is not natural and given, but social. The proposition made its way to another proposition which is the key pillar of argument for the research. Since time is social, and as such it can be affected by information technologies which have been influencing every aspect of the contemporary society. Social time is characterised by its conventionality. The two historical episodes during the French Revolution and the Russian Revolution were presented to exemplify the conventionality of social time. Then the history of mechanical clocks was briefly examined. Mechanical clocks, which became reliable in the late seventeenth century, have since greatly influenced the view of time, and furthermore the view of world in the early days of industrial age. Above all, the clocks severed the bond between time and human events and between human events and nature (Mumford, 1934; Landes, 1983). They also played a role in the shaping of the early industrial capitalism by affecting labour disciplines (Thompson, 1967). Finally, it was proposed that computers could now change time just as the clocks did in the past. Information technologies can affect our perception of time, the way we organise our time at work and leisure, our view of time and thereby our view of the world. This research was initiated to address the issue of how information technologies affect temporality. At an empirical level, it intends to investigate how a specific information system affects temporal orders of work in a work situation.

In Chapter 2, a classificatory scheme for studies on time in organisation and management studies was presented. It is built by intersecting two criteria: the concept of time and the role of time in research design. In the former, two contrasting concepts are found in studies on time: clock time and social time. In the latter criteria, there are two different variables which time assumes in various studies about time: independent and dependent variables. The intersection of the two criteria produced a matrix of four categories of management and organisational studies on time. Each study on time in management and organisational theory was mapped and examined in an appropriate category. A literature review founded on the scheme showed that while many studies based on the concept of clock time were placed in category I and II, a relatively small

number of studies was found for category III and IV built on the social time concept. The differential number of studies between the two groups reveals that many more studies on time in management and organisational theory rest on mundane conceptions of time, such as the clock time concept and the monetary notion of time, than on the social time concept. Another disproportion is found between category I and category II, and between category III and category IV. It shows that researchers tend to think time more as a constant given in cultures or organisations rather than a variable which can be changed by various social and organisational elements including technology. It was concluded from the literature review that there is little '*research on time*', although we have much '*time-related research*'. In most studies of time in management and organisational research, the nature of time is not questioned and time is regarded as taken-for-granted and unproblematic. Finally, it was suggested that more research is needed in category IV and that it should be empirical and address the notion of time which is social and changeable.

Chapter 3 addressed the question of what constitutes temporality and presented the six dimensions of temporal order: duration, sequence, temporal location, deadline, cycle and rhythm. The original twelve dimensions which had been derived from some preceding studies (Schriber, 1986; Schriber and Gutek, 1987; Zerubavel, 1981) were modified and reduced to the six dimensions during the fieldwork. They were used when temporal changes in the cases were described and analysed. Chapter 3 also presented research method and field procedures. The case study method was employed as a research strategy. The method is justified because little previous research has been carried out and therefore profound investigation is required for exploration and hypothesis generation (Benbasat et al., 1987). The following research issues were derived from previous research. They were investigated in the context of KTNET.

- temporal flexibility in organisational work
- internal and external flexibility
- monochronicity and polychronicity
- temporal changes and social relations within organisations

- temporal adjustments among organisations

Built on theoretical and conceptual discussions in Part I, the following chapters in Part II addressed the research question in a real organisational work situation. Chapter 4 presented background knowledge about the fieldwork sites. It introduced a typical process of international trade, the letter-of-credit cycle. It was followed by an introduction to Korea Trade Network, an electronic data interchange application for trade automation. Then it described the three case study companies. In Chapter 5, four main tasks of export procedures were selected from the whole process of documentary work for export: advice of master letter of credit, application of export licence, application of local letter of credit and negotiation, to which KTNET was applied. Work procedures were described in as much detail as possible for all the four tasks. The descriptions focused on differences between work procedures before and after the introduction of KTNET. In so doing, shifts in the six dimensions of temporal order were tracked down.

In Chapter 6, the six dimensions of temporal order were analysed in the four tasks of export procedures. The analysis showed that KTNET affected the six dimensions. However, not all the six dimensions were equally transformed in all the four tasks.

- Duration and cycle are considerably shortened in all the four tasks. It seems obvious that information technology has a potential to reduce duration and cycle. Apart from the reduction of cycle, a tendency was found in which various cycles in each task were converging.
- Temporal location was also affected in most of the tasks. The implementation of information technology in work places tends to bring with it new temporal arrangements as regards the temporal location, namely when to perform what.
- Contrary to general expectations, deadlines were not universal in all the procedures investigated in the fieldwork. The impacts on deadline are various. Where deadlines existed, they became loose. A deadline emerged where there was no deadline.
- Sequence and rhythm were slightly affected in some of the areas investigated.

The followings are findings on organisational and managerial implications which accompanied changes in temporal orders of some export work.

- KTNET increased the flexibility in some export administrative work so that old rigid time-frames were replaced by more flexible time patterns. The workers involved can organise their work time more flexibly.
- The distinction between internal and external flexibilities was hard to find on the site of KTNET. Only one occasion was found in which the rigid temporal pattern of an adjacent (accounting) department restricted the full realisation of internal flexibility in work procedures.
- As regards monochronicity and polychronicity, KTNET increased the polychronicity of some workers in export procedures in organising their work time. This was compared with Barley's study. While they appeared contradictory, closer scrutiny revealed something common between them. Information technologies performed the function to make a temporal symmetry in both cases; a symmetry between the way tasks and events take place and the way workers operate on the site of KTNET, and a symmetry between radiologists' and technicians' work worlds. This we named a theory of temporal symmetry.
- KTNET affected social relations between individuals or functional departments in some areas of the field.
- Finally, it caused new temporal adjustments between transacting organisations, especially adjustments of when to transact, i.e. of temporal location.

B. Contributions of the Research

This research has useful implications for information systems in practice as well as in theory. It also contributed to a broader area of studies on time in management and organisation theory by devising a new classificatory scheme of studies on time and building a theory of temporal symmetry. Contributions to other areas of study are important for information systems research. To establish it as an independent discipline, it is not enough to be interdisciplinary in addressing IS-related issues through borrowing concepts and theories from other disciplines and applying them to the information systems area. Knowledge which is gained by interdisciplinary effort with other disciplines should be recognized by the disciplines themselves, and it should influence and benefit them by giving the knowledge back to them and thereby increasing their knowledge.

1. Implications for information systems research

As repeated throughout the thesis, time has not been explored well enough by researchers in information systems for its fundamental importance in organisations and society. When it comes to the specific issue which this research has addressed, namely how information technology affects temporality, we have only the simple knowledge that information technologies have accelerated the speed of work at an enormous rate and saved us a great amount of time. Through case studies of KTNET, this research provides a detailed account of the relationship between temporality and information technologies. It helps us to understand concrete patterns in which information technologies affect temporal order in a work place.

In addition, this research contributes to information systems research in the following two ways; it provides a means to analyse cultural impacts of information systems on organisations, and as a result, can assist in gaining knowledge for successful implementation of information systems. Any new system, e.g. a technical innovation, affects the culture of an organisation or society which adopts it. Evaluation framing (Stamper, 1988) described in Chapter 1 was devised to provide researchers with a systematic way of analysing

the cultural impacts of an innovation. However Stamper did not go beyond this conceptual suggestion. By selecting time from the ten streams of cultural messages and addressing it with a focused effort, this research intends to advance research on cultural impacts beyond the conceptual level to the empirical level in organisational settings. As such, this research can be positioned on a wider map of research which aims to understand the cultural impacts of information systems. Arguably, it provides a first step towards it.

The knowledge of cultural impacts of information systems gained through research like this can contribute to the successful implementation of information systems. It is said that many systems have failed because developers and systems analysts have not taken into account social, political or cultural aspects of information technologies in organisations. It is recommended that they should take them seriously when they develop and implement information systems in organisations. However, recommendations have so far been given only as a principle which is declared without substance, not as guidelines which can be referred to in practice. While some studies exist as regards political aspects of information systems implementation such as control, power, politics, etc. (Bloomfield and Coombs, 1992; Markus, 1983), there are few studies to be consulted for cultural aspects. Hassard insisted in a recent paper (1996, p. 596) that because temporal structuring is at the heart of organisation, temporal factors should be of primary concern when organisations are designed or changed. Temporality has been ignored in information systems research, which can be claimed as an obstacle to understanding computer-initiated organisational changes in which time is a key element. We need to take into account temporal factors when we design, develop or implement information systems in organisations. Even a small amount of knowledge of how information technology shifts temporality in organisations will contribute to the design and development of effective information systems. In this respect, this research is believed to add some new knowledge to information systems research.

From a more practical point of view, the knowledge of temporality and computers gained in this research can be applied to other issues on IT, work and

lifestyle. For example, nowadays there is much discussion of teleworking. The prefix 'tele-' meaning 'at or over a long distance' gives the impression that teleworking is only concerned with the place of work, home or office. A second thought reveals that teleworking is not just a matter of place, that is, where to work. One of underlying issues of teleworking is time, when to work and how to organise time for work and leisure. This temporal approach to teleworking will help to develop a teleworking system which is easily and widely accepted by users. Furthermore, one of the findings in this research suggests that we can develop information systems which enhance a temporal symmetry in which work groups or departments in an organisation operate more effectively, whether it is a polychronic or monochronic way of working. Temporal considerations should also be taken into account in the development of interorganisational information systems (IOS). Whenever a new EDI system is put into use on the sites of the case studies, it brings with it a new temporal arrangement between the organisations involved in the system.

In summary, this study contributed to the increase of knowledge in information systems research by raising a fresh issue of time and information technology, more specifically, how computers affect temporality in organisational work, and initiating a theory which can be corrected and developed by further research. The potential of this temporal research is not limited to the information systems area. It can be extended to studies on time in management and organisation theory. The next section deals with contributions made by the research in this wider area.

2. Mapping studies on time and the theory of temporal symmetry

The literature review in Chapter 2 showed that a fairly large number of studies about time existed in management and organisation theory. However they remained dispersed in various and wide areas of study ranging from psychology and organisational behaviour to industrial relations and business strategy. There was no way to present them in an organised way. The classificatory scheme provided an organised way in which various studies on time in management and organisation theory can be classified. It not only described current situation of

studies about time in this area, but also showed a direction towards which further research efforts should be made.

From case studies where impacts of KTNET on temporality of some export work procedures in trading companies and bank branches were investigated, the theory of temporal symmetry emerged. According to the theory, information technologies perform a function to build a temporal symmetry. The theory is based on the distinction between the temporal behaviour of events/tasks and the temporal behaviour of workers, which is originally devised in the research. When there exists a conflict between the two domains of temporal behaviour or within each of them, for example, where there is a difference between temporalities of work groups or departments, information technologies make a symmetry between conflicting temporalities. This theory of temporal symmetry can be a starting point for further research in this area. At this stage of research, it is premature to make more general or decisive statements on the relationship. Therefore no further attempt is made here to decide which trend, monochronicity or polychronicity, information technology facilitates, whether information technology will *always* create a temporal symmetry, and if not, under what condition it does. To make it a theory of substance, more research is required. It is a contribution of the research that it triggers interests and initiates a theory which should be modified and elaborated by further research in management and organisation theory.

C. Suggestions for Further Research

1. Limitations of the research

This research started with a sociological proposition that time is socially constructed. It was followed by a distinction between social time and clock time. It is argued that the clock time concept is too narrow to cover complex organisational dynamics of temporality, and that it should be complemented by other temporal concepts which could recognise time as being social and changeable. Among the four categories of the classificatory scheme of studies on time, the research was intended to address category IV, in which time is dealt with as social and as a dependent variable. It also aimed to bring the research focus out of mundane concepts of time which are typically expressed by the aphorism that time is money and in some economic terms such as efficiency, productivity, time-saving, and so forth. One of its purposes was to pursue profound concepts of time which could provide useful ideas for interpreting and understanding information systems in changing organisations. Looking back on the fieldwork procedures and the findings and results of the research, it was found that the social time concept was not addressed enough as declared at the beginning. At least, the research did not put across the repeated banal message of monetary time. Furthermore, it successfully described in detail changes in temporal dimensions of organisational work induced by information systems. This description of temporality has not been conducted yet. Finally it had partial success to understand social implications of temporal changes in the case study companies. However, it is difficult to avoid criticisms that the broad meaning of social time was not fully sought after and reduced to another aspect of the clock time. This defect can be attributed to the following limitations.

Barley (1988) distinguished between the structural and interpretive aspects of a temporal order. Structural attributes are external aspects of a temporal world such as the six dimensions of temporal order that were investigated in the research. Interpretive attributes are concerned with people's perceptions on those external aspects. They evaluate events and tasks against the external aspects, and might perceive the events to be boring/attractive or

fair/unfair. From the perceptions, they interpret the temporal situations in which they are involved; they judge whether something is wrong there, whether they have done a good job, or whether others have acted responsibly (Barley, 1988, p. 129). He argued therefore that "structural asymmetries are necessary but insufficient conditions for social conflict", adding that "asymmetries must be interpreted in ways that justify contention". In this research, some changes in temporality were interpreted from the perceptions of the workers concerned as seen in the deadline of local letters of credit, others were not. To take an example, converging cycles described in Chapter 5 may influence workers' perceptions of their work situations. However such psychological impacts were not examined in the fieldwork. In brief, interpretive and psychological aspects of changing temporality were not sufficiently investigated here.

This research was based on case studies which mainly consisted of interviews and internal documents. A few observations were made on a very limited condition. As the fieldwork advanced, the author found out that comprehensive and intensive empirical work was required for the issue. Changing temporality was an elusive problem and it was difficult for a researcher from outside to track it down fully. Barley already mentioned that the internal parameters of a temporal world are not obvious to a casual observer whereas the external aspects can be described more or less reliably by an independent observer (1988, pp. 128-129). The lack of previous research which directly dealt with the issue of temporal implications of information systems made the matter worse. There were few proper concepts available with which to describe temporal phenomena at work and no theory was found to be used as a reference. To overcome this limitation, empirical work which is more intensive in its depth of inquiry and more extensive in its scope beyond the departmental level up to the organisational level, is demanded. The case studies which were conducted for this research were not sufficient to do the job.

2. Further research

From the limitations described above come out suggestions for further research. First of all, an ethnographic type of fieldwork is recommended to conduct more intensive and comprehensive inquiry into both structural and

interpretive aspects of changing temporality induced by information technologies in organisations. Such ethnography is expected not only to bring forward more details of structural profiles of temporality, but also to show interpretive parameters more clearly. More effort should be invested to search for psychological and, more or less, subjective aspects of changing temporality, namely how people's perceptions about time is being transformed, how their organisation of time at work and at home is changed, and thereby how different their view of the world surrounding them, especially their work world, is in terms of temporality from the view of previous generations. These are a few of the questions which are expected to be addressed and answered by further research in the future.

This research is exploratory not only because of the limitations of the research mentioned above, but also because of the current situation in which the research topic is located. Lack of the previous research on the subject of time and information systems does not allow the author to make more conclusive and general statements about it. For example, the theory of temporal symmetry which was developed in the research is based on only the two case studies, which are different in the nature of information technologies examined and of organisations against which case studies were conducted. Different types of information systems such as individual and group decision support systems, systems for computer supported cooperated work, interorgnisational information systems, etc. in different work (professional) situations such as clerical workers, middle management, managerial executives, accountants, etc. in different organisational backgrounds of history, industry, etc. can make a difference to the theory. Therefore before we can make more conclusive and decisive statements about the issue and generalise, correct or abolish the theory, we need more case studies examining various types of information systems in various organisations.

Appendix A: Collecting and Analysing Data

Three different types of data were collected during the fieldwork;

1> data describing working procedures before and after KTNET in each sub-domain,

2> data on changes in the six dimensions of external temporality, and

3> data on organisational implications of those temporal changes.

For the first type of data, the main sources were interviews with the key informants in each company. They explained to me the working procedures before and after KTNET in each sub-domain in detail. I asked them to produce diagrams describing the procedures. They also provided internal documents which confirmed or supplemented the diagrams. In the interviews with workers, I showed them the diagram of the sub-domain under their charge and asked whether it was correct. The workers reconfirmed most of the diagrams and disagreed with part of some. When differences were found, I contacted the key informants after each interview or later (before another interview) and corrected them, if necessary. The products of the process described above are the figures in Chapter 5.

For the data on changes in the temporal dimensions, the two diagrams of the working procedures before and after KTNET in each sub-domain were used as a starting point. Showing the interviewees the two diagrams, questions on the six dimensions were asked in turn. In each dimension, questions on before procedures preceded ones on after procedures. Another possibility was once considered that the six dimensions of the before procedures were examined first, and then those of the after procedures were examined. It looked simple and straightforward. This approach was not taken because the main purpose of the examination was to compare each dimension between before and after procedures. Tables 5-1, 5-2, 5-3 and 5-4 describing changes in temporal dimensions in each domain were built upon those comparisons above.

The data for organisational and social implications of the changes in the temporal dimensions were collected through direct questions which were constructed based upon the research issues. These data were different from the above two in that

they required more or less interpretative effort. They became the basis of Chapter 6.

C. Implications of Changes in Temporality.

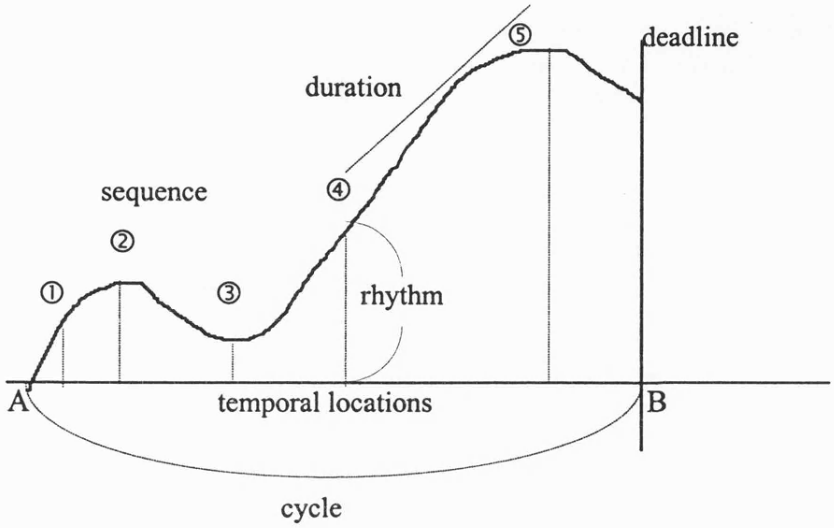
Appendix B: Calibration of the Temporal Dimensions

The six dimensions of temporality were proposed in the thesis. This appendix is intended to clarify the way they are calibrated and present their applicability in the future research. They were devised with an intention to distinguish the temporal analysis in this research from clock time analysis. Throughout the research, careful attention has been paid not to rely on clock time.

However, this research can be criticised in that the measurements of temporality are not rigid and consistent. Admittedly, they are not, but only from the viewpoint of the clock time. In this research, the temporalities were not described using the standard unit of the second, minute and hour. They were presented by system developers' and users' own language. If they used the hour in describing their work, I employed it. If they told of their time using terms such as 'after lunch time', 'in the morning' and 'half a day', I adopted them. Looking back, while it is not as successful as intended to research into the social time at the beginning, it is successful in that at least it did not paint an ordinary picture of the temporality based on the clock time.

One idea which could distinguish the temporal analysis based on the six dimensions from clock time analysis was suggested at the end of the research. The figure below presents it. It gives a possibility to describe and analyse temporality without depending on clock time. In the figure, the segment from A (a starting point) to B (a finishing point) on the horizontal line represents a cycle of the work. The vertical line at B is a deadline. The numbers on the curve represent sequence. The length of the line drawn from the numbers to the horizontal line shows rhythm. When it is long, it indicates a busy period. In the figure, point 5 is the busiest time as the work is approaching the deadline. The points where the vertical lines meet the horizontal line represent temporal locations. Duration is represented by the length between the numbers on the curve. Being on the curve, it can reveal more than what clock time can show on the horizontal line, that is, the difference between temporal locations. For example, psychological duration which people feel is different from duration by clock time.

Figure



Temporalities of each sub-domain in the research can be described in a similar way, which was not attempted. The figure is still a suggestion at this stage and requires elaboration for future use.

Appendix C: Interview Scheme*

Introduction: KTNET and Changes in Work and Time

You and several other people in your department are being asked to participate in a academic study on KTNET and changes in work and time. This study is designed to investigate changes in work and time since the introduction of KTNET, and is being conducted as a part of a university research project. It would be grateful if you, as a participant, present what you know about your job as much as you can. It is very important that you answer all the questions I am going to ask. This interview was permitted by your company so that you have no reason to hesitate answering some questions. In addition, I promise that you will remain anonymous.

There are no right or wrong answers. Most questions are easy to answer because they are all about your ordinary job. The interview will probably last about 30 minutes.

Do you have any questions about the interview or the study before we start?

* The Korean version of the interview scheme is available from the author on request.

A. General information about interviewees and their department

1. What is your job and post? (export letters of credit advice, export licence, local letters of credit, negotiation)

2. How long have you worked in this department and in the company? (How long have you done the job specified above?)

3. How many times does the job (_____) take place a day? (How many times do you deal with it a day?)

B. Work procedures and dimensions of time

4. Could you explain work procedures before KTNET? (* Ask this question in a way that I can confirm or complement what I have already known through preliminary examination rather than in a way that I just listen to the explanation.)

5. Could you explain work procedures after KTNET? (* Ask this question in a way that I can confirm or complement what I have already known through preliminary examination rather than in a way that I just listen to the explanation.)

< Sequence >

6. Please describe your daily activities to deal with the job (_____) in order from morning to evening before KTNET.
   Please describe your daily activities to deal with it (____) in order from morning to evening after KTNET.
   Before and after KTNET, to get the work done, do you have to perform tasks in the order specified? Can you perform them in a different order?

< Duration >

7. Before KTNET, how many days or hours did it take to process one order of (_____)?
   After KTNET, how many days or hours does it take to process one order of (____)?

8. (Duration of unit tasks) How many hours or minutes does it take to process each unit task of (_____)?
   - Before KTNET
   - After KTNET

< Temporal location >

9. When do you deal with each unit task in a day? (answer in terms such as morning, before noon, early afternoon, late afternoon and before leaving office or in hours)
   - Before KTNET
   - After KTNET

10. (predictability and adjustability of temporal location) Can you anticipate the time when the job takes place? Or can you decide the time on your own?
   - Before KTNET
   - After KTNET

< Deadline >

11. Is there a deadline which you have to meet in performing each unit task?
   - Before KTNET
   - After KTNET

12. Is there a deadline which your department as a whole have to meet?
   - Before KTNET
   - After KTNET

< Cycle >

13. How long is the period of completing a round of (_____)? It does not mean a period in which an order of (_____) is processed. It is a period which starts and closes a round in continuous work flow (e.g. usually a daily cycle). How many do you cut the flow into shorter periods a day, if any?
   - Before KTNET
   - After KTNET

< Rhythm >

14. What time are the busiest time of the day and the least busy in processing the job of (____)?

    - Before KTNET - After KTNET

15. What day are the busiest day of the week and the least busy in processing the job of (____)?

    - Before KTNET - After KTNET

16. About what date are the busiest day of the month and the least busy in processing the job of (____)?

    - Before KTNET - After KTNET

C. Overall questions

17. (Relationships within a department) As regards the changes in work procedures of (____), have there been any shifts in the division of labour or in the confirmation process by superiors in your department? What impacts do the shifts have on work groups in the department? (Remind interviewees to pay attention to temporal aspects.)

18. (Inter-departmental relationship) What other departments are involved in the process of (_____)? Please explain inter-linking points with those departments in the work process.

    - Doesn't the new way of working conflict with other departments' ways of working? In other words, does the fact that while your department's way of operating is transformed, the other departments operate in an old way, obstruct the smooth processing of (_____)?

    - Do you think that the new way of working is equally effective beyond your department from the viewpoint of your company as a whole?

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