SESSION 1 – WORKING AND PLAYING WITH VISIBILITY
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The Rise of the Techno-Service Sector: The Growing Inter-Dependency of Social and Technical Skills in the Work of ERP Implementers[1]

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This paper attempts to move away from portraying service and knowledge work as opposite trends in advanced economies. Instead, it maintains that a closer look at the changing nature of work will highlight the need to rearrange our aggregate occupational data so as to include special categories for a hybrid form: the techno-service sector. After presenting a typology of occupations based on the degree to which knowledge and service elements are intertwined, the paper analyze the work of Enterprise Resource Planning [ERP] implementers as a key example of techno-service work. It highlights the practices of 'reverse customization' and 'translation' performed by the implementers, which effectively combine service and knowledge work. The paper explains the growing inter-dependency of social and technical skills by the shift from the sale of a product to the sale of a process. This shift underpins the growing penetration of professional work into the heart of the industrial enterprise.

Introduction

Creating a so-called "knowledge economy" has become a major goal of many advanced industrial societies such as the USA and the UK (see Blair, 1998; Reich, 1993). In some of these societies this sector of the economy seems to be growing rapidly. Reich (1993), a former US secretary of labor, who sees the American knowledge sector as a key to sustained growth, claims that the number of symbolic analysts in the US workforce rose from around eight percent in the 1950s to around 20 percent by 1990. Analyzing occupational trend data between 1950 and 1990, Castells and Aoyama (1994: 23) confirm that white-collar work has expanded in the advanced economies, mostly among managers, professionals and technicians, whose occupations they term 'informational'. Barley and Orr (1997: 3) further claim that "The number of professional and technical jobs in the United States has grown by

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more than 300 percent since 1950" and that "no other occupational sector has experienced nearly as great a growth rate." More recently, Hecker (2005: 71) in his analysis of the BLS occupational employment projections for 2004-2014 states: "…professional occupations are projected to grow the fastest, chiefly because they are concentrated in some fast-growing sectors, such as health care and social assistance as well as *professional, scientific, and technical services* …" (italics added). While we witness the proliferation of scholarly work about the knowledge sector and knowledge workers in the sociological and business literatures, these terms remain underdeveloped and poorly defined. This is largely due to scholars' neglect to conduct ethnographic explorations of the knowledge sector.

As Darr and Warhurst (2007) point out, sociologists in the sub-field of social stratification were the first ones to discuss the rise of what they depicted as a new middle class composed of workers such as managers, salaried professionals, technicians, some salespeople and office workers (Mills, 1951). What is unique about these workers is that they carry their 'means of production' (expert knowledge) with them. Rather than show empirical interest in the nature of the work that the members of this emerging class performed, sociologists were more inclined to discuss the political and socio-economic ramifications of what they perceived as a changing class structure.

Business scholars, on the other hand, were hardly interested in stratification changes, but instead focused on the managerial challenge posed by an emerging and highly educated class of workers, who were unlikely to simply adhere to managerial imperatives given their formal education and strong occupational communities. The managerial literature has tried to device new ideologies and control mechanisms which could allow for the effective utilization of knowledge work. Among these are team work and strong organizational cultures.

In the business literature, as well as in the sociological literature, the term knowledge work is defined broadly as white-collar workers, including teachers, lawyers, politicians, scientists, social workers, accountants and computer programmers. As in the sociological literature, the terminology describing these workers varies, and is often employed with no reference to specific occupational groups or to a clear definition of the term. What Darr and Warhurst (2007) see as common to sociologists and business scholars writing about knowledge work, is their complete neglect of work practice. Without a close look at the daily realities of the knowledge sector, they argue, there is little hope of understanding this line of work, the skills it comprises and how it is integrated into the emerging division of labor in advanced societies.

While any kind of job requires some type of knowledge, there is a set of specific questions about knowledge work which is currently left unanswered. These include: What types of knowledge are employed by knowledge workers in their daily work? What is done with this knowledge? Where is the knowledge nested (in the person, the organization, the occupational community)? These questions could only be answered by in-depth interviews and or observations of knowledge workers in action. This paper tackles a gap in the literature

by an in-depth exploration of the working experience and perceptions of implementers of Enterprise Resource Planning (ERP) software.

The ERP software is designed to create an online organization, with workflows, documents and forms going online. ERP implementers fall well within the core definition of knowledge work. This group is comprised of software engineers and programmers as well as 'content experts" such as former HR managers or economists, who have a deep understanding of a specific area in which the ERP software in implemented such as the finance or the HR department. Yet, this paper will go beyond a description of the type of knowledge and skills these workers perform. It will also question the analytical distinction between knowledge and service work, which underpins most accepted classifications of work. Service and knowledge work are often perceived as standing at opposite ends of the occupational status ladder. In contrast to this perception, this paper will point to the growing interdependency of technical and service work, and more importantly, to the rise of a techno-service sector. The workers in this sector combine in their daily work, scientific, technical and service knowledge, and the content of their work poses a serious challenge not only to existing classifications but also to training programs in science and engineering, as well as in the service sector.

The Polarization Thesis

Two seemingly opposing trends shape the current landscape of the American workforce. On the one hand, ample data point to the rapid growth of the service sector, typically described as producing low-skilled and low-paid jobs. On the other hand, the literature is replete with studies heralding the birth and rapid growth of the knowledge sector, composed of highly skilled individuals who hold college degrees and enjoy wide occupational autonomy and a high salary. These opposing trends seem to contribute to the polarization of the US labor force, that is, to the dwindling of semi-skilled jobs and of the middle class as a whole (for a review and critique of this thesis see Autor, Katz and Kearney, 2006). Figure 1 graphically depicts these two trends.

Figure 1. Major trends in the US labor force

While both trends seem to be well grounded in empirical research, sociologists as well as economists tend to treat them as vectors pointing in opposing directions. But they fail to identify the growing interdependency of service and knowledge work since they use ready-made occupational classifications and do not attempt to critically examine the changing

nature of work within occupations. I claim that the robust interface between service and techno-scientific work (which here I equate with knowledge work) creates new skill compositions and blurs traditional divisions of labor. The growing interdependency of social and technical skill is rooted in a shift in advanced economies from sales of a product to sales of a process in high-tech markets, and carries important implications for educational programs.

In emergent technology markets the substitution of a process for a product is grounded in the lack of a clear agreement between sellers and buyers about the future use of products (See Darr, 2006). For example, in the software industry sellers often sell a concept, a goal which must be negotiated and customized through a lengthy process. Likewise, software implementation (e.g., ERP systems) and various consulting jobs involve exchange of a process rather than a traditional product. More generally and in other industries, a few scholars (see Pine, 1993) have claimed that "mass customization" is substituting mass production as the main production paradigm. Computers and computer-integrated machinery, according to these writers, allow service and manufacturing firms to shift from mass production to mass batch production or mass customization. This flexibility in production also accelerates the shift from selling a product to selling a customization process. Selling a process causes technical experts to stream to frontline positions where they interact directly with the clients' representatives.

Knowledge has always been utilized in work practice. My position is that what is new about knowledge workers is the increasing integration of service and technical skills. The polarization thesis is based on income distribution of aggregate occupational data, which do not provide indicators of the different ways in which work is carried out within existing occupational titles. While I do not dispute polarization, I am opposed to the assumption that polarization occurs along the traditional service-knowledge dichotomy. Instead, I maintain that a closer look at the changing nature of work will highlight the need to rearrange our aggregate occupational data so as to include special categories for a hybrid form: the techno-service sector.

The growth of techno-service jobs has already made an impact on the US labor force. For example, Hecker (2005: 71) in his analysis of the BLS occupational employment projections for 2004-2014, point out that network systems and data communications analysts; computer software engineers, application; and computer software engineer, system software; are three out of the ten fastest growing occupations in the US labor force. These three occupations, I claim, combine sophisticated knowledge and skill with strong service elements. Others such as dental hygienists and medical assistants can also be seen as members of the techno-service sector. The growth of a techno-service sector poses a substantial challenge to our educational institutions, which tend to view knowledge workers as the ideal type of industrial R&D engineers or scientists. I suggest that simply offering students more of the same (e.g., enhancing science and math classes in K12 and undergraduate programs) will not create a better fit between many of the graduates and future labor market demands. Instead, new types of skills such as interactive social skills and the creation of a technological dialogue (Pacey, 1993) should be integrated into engineering and scientific training.

Figure 2 below represents my attempt to move away from portraying service and knowledge work as opposite trends or opposite ends on the status and income ladder and instead to create a typology based on the degree to which knowledge and service elements are intertwined in a specific line of work (see Darr, 2007).

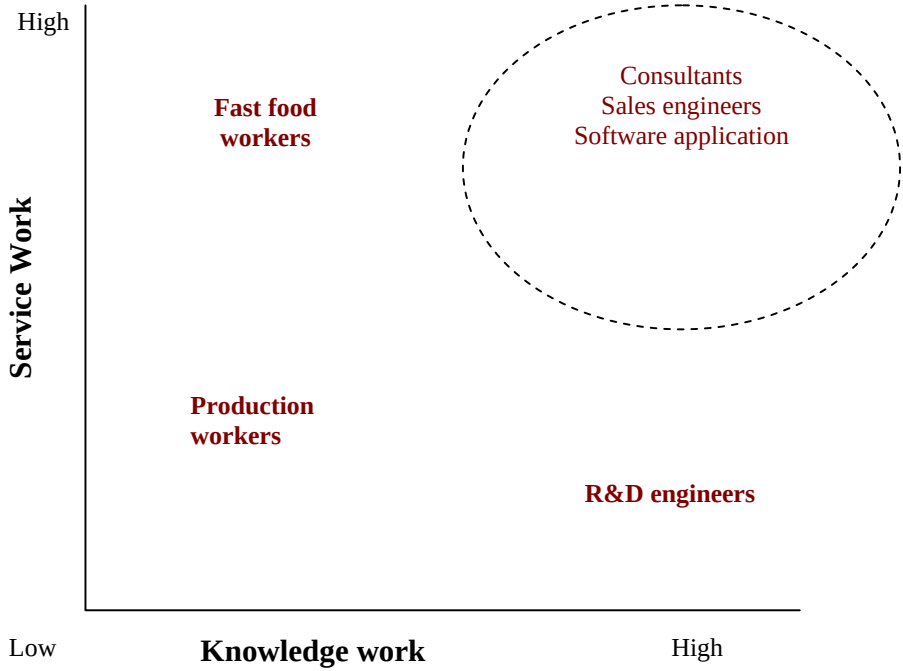

Figure 2. Occupational typology based on service and knowledge elements

As figure 2 shows, traditional manufacturing jobs are low on both service and knowledge elements. Burger flippers and waiters are high on service but low on knowledge elements. Scientists and R&D engineers, who are typically buffered from market exigencies, are low on service elements but high on knowledge elements. However, I believe that at the core of the so-called "knowledge economy" is the rise of a group of occupations that combine service and techno-scientific elements in their daily work. These occupations include, but are not limited to, software application engineers; technical support; engineering and scientific consultants; software implementers; some qualified call center workers and detailers. An ideal type of these occupations is sales engineering.

There is a growing literature which focuses on work practice, with an emphasis of the interrelation of technology and work (Bechky, 2003; Goodwin, 1997; Suchman et al., 1999) A small body of literature in sociology of work practice has recently suggested that sales departments in industries leading the current transformation of the socio-economic infrastructure are undergoing a technization process (Darr 2002). For example, in US leading-edge industries the percentage of engineers holding formal academic degrees in the sales force almost doubled during the 1980s, from 12 percent to 22 percent (US Department of Labor 1985, 1988, 1991). The BLS figures project a growth of 14 percent in the number of sales engineers in the years 2004-2014. Similarly, sales support in the software industry increasingly involves technical experts (Pentland 1997).This is a clear, yet limited, indication that knowledge and service work are intertwined. Increasingly, firms are oriented to their clients and must enhance their workers' social skills to provide quality service, in addition to exhibiting technical competence in producing high-quality goods. In this paper I focus on ERP implementers as a key example of an emerging cluster of occupations where social and technical skills are interdependent.

Research Design and Methods

At the heart of this study are data derived from 50 in-depth interviews with key players in the Israeli ERP market. Table 1 provides a breakdown of interviewees by occupation.

Table 1. Interviewees by occupation

Occupation	Number of interviewees
Project managers	6
Sales and marketing	5
Freelancers	6
Implementers working for implementing organization	9
Representatives working for client organization	12
Programmers	3
Training and education	3
Consultants	2
Entrepreneurs	2
QA	1
VC manager	1

The sample was created by a snowball technique, which began with leads provided by several different people working in implementing business software, or members of client organizations. These people suggested other potential interviewees. When one snowball stopped rolling I began another. Since the snow ball sampling started from different actors which were not previously linked, I was able to avoid the danger associated with this research method of getting caught up within a single clique.

The study also included a newspaper archival research aimed at providing the history of the Israeli ERP market. Observations were conducted at a day long sales promotion carried out in a Tel-Aviv Hotel, where SAP representatives presented the software and a line of satisfied clients to prospective buyers, all high ranking managers from very large corporations.

The initial objective of this study was to identify the different players in the ERP market and to locate each of them within the broader, and as we shall see, the global division of labor. Figure 2 provides a graphic presentation of these issues:

Main Players and Work Process in the ERP Implementation Sector:

SAP is a German company manufacturing ERP software. SAP is a giant company, with an annual income incomes of about 4.6 Billion US dollars, which represent 40% of the total revenues in this market (The Marker, Sep. 15, 2008: 34). The SAP ERP software creates an online organization, with workflows, documents, forms and authority structures all being boxed within the software, which is made up of a large number of modules. These are designed to cater to the needs of various organizational functions: finance, logistics and human resource management, among others. SAP claims that its software is standard yet very flexible, mainly due to its built in customized menus, thus requiring little if any adaptation to specific client's needs. Yet, as we shall see, implementing ERP software is lengthy and complex, and there is a flourishing sector of ERP implementers who thrive on software localization.

Up to a few months ago SAP had only one vendor in Israel, NESS Technologies, which was authorized to sell the software licenses. SAP provides technical support for organizations that have purchased their software mainly through NESS but also directly via the Internet. In addition to being, up until recently, the only licensing company for SAP products, NESS provides ERP implementation services and acts as intermediary for SAP and the Israeli clients. Given its wide array of functions, the company employs marketing, implementation, programming, and training personnel.

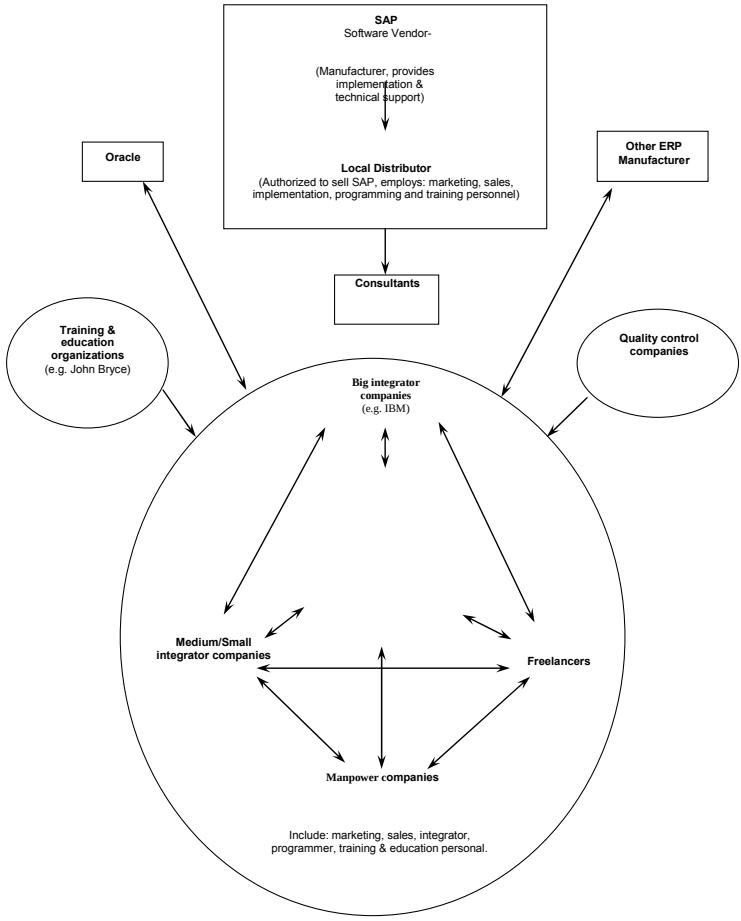

Figure 2. Occupational typology based on service and knowledge elements

While NESS until very recently held a monopoly over licensing, it has to compete with global and local firms in the ERP implementation market. Other global implementers include IBM, which is NESS's biggest competitor, as well as HP and other companies. A number of local Israeli firms also offer ERP implementation services. These small and local companies employ a range of consulting, implementation, and programming personnel. They typically do not win significant implementation contracts, but are instead subcontracted by larger and often global consulting firms. The smaller local firms provide expert workers when there is a need, and constantly train their workforce both formally and by work experience. A few HR and head hunters also specialize in providing personnel with

ERP implementation skills, both locally and globally. Unlike the small implementers, the HR companies do not engage in any technical work or sub-contracting.

Large and Often Global Implementation Companies

The large global companies typically employ project managers and a small number of key programmers. Once they sign a contract with a client, they construct a project team led by their own employees, but composed largely of programmers and content experts which are sub-contracted from the smaller local firms. At times the global firms also hire local freelance workers who specialize in one or two software modules. I will elaborate on the unique sub-contracting system in this field when describing the division f ERP implementation division of labor.

Small/Medium Implementation Companies

Consultants: Usually with a computer system background, and who formerly worked in large organizations, these are people who help client organizations during the implementation process, from choosing the right software to quality control.

QA companies: These small consulting organizations provide quality assurance for ERP software implementation. They examine and evaluate the process of implementation as well as the outcomes. Obviously they are hired by the organization in which the implementation take place and supervise the work of the implementers.

Implementers: These are people who specialize in one SAP module or more, usually working for an implementing organization (unless they are freelancers). They work with people in the client organization during the implementation process (e.g. key users). When their job in one project ends, they move on to another client organization.

SAP programmers: These specialize in ABAP, the SAP programming language. They usually join a project after initial characterization of the project has been completed.

Training and education personal: These are experts in documentation and in training others to work with SAP. They are usually the last to join a project. At present John Bryce is the biggest company providing such services in Israel. Implementation companies may have their own training and education departments (e.g. NESS).

Client organizations These are the organizations interested in purchasing ERP software, as well as the services of an implementing organization. Management has to win the support and the aid of key users who represent workers in various organizational departments (e.g. HR, manufacturing, etc.) in order to achieve a successful implementation.

A Short History of the Israeli ERP Market

The literature search, a search of newspaper achieves coupled with interview data, provided the following general and short history of the ERP market in Israel. The market for organizational software in Israel, before the time of ERP, has emerged in the 1970s, gained popularity in the 1980s, flourished in the 1990s, and suffered a setback shortly after 2000 as a result of some disappointments by clients who experienced difficulties during the implementation process.

During the 1990s, various consulting firms identified the need for the creation of companies that could implement ERP systems, and they began specializing in this field. Eventually a company called NESS was created out of the consolidation of several consulting firms. Up to 2008 NESS was the only company in Israel allowed to sell SAP licenses, and still is a major implementer in the Israeli market.

In the past, three software manufacturers controlled the Israeli ERP market: *SAP, ORACLE*, and *BAAN*. The last has all but vanished, while SAP came to control the major portion of the Israeli market. In addition to manufacturing companies, other implementation organizations operated in the Israeli market which included:

New-Aplicom Founded around 1982, specializes today in implementing ORACLE, also represents "PeopleSoft" in Israel.

ORACLE representing its own product. ORACLE has also been chosen to implement its software in a number of big Israeli organizations: the ministry of defense, the air force, and the military in 2001, and Teva in 2002.

The first SAP ERP projects in Israel were implemented in 1995. These were implemented by TEKEM in Osem and Paz, followed by Merkavim in 1998, the MERKAVA project in 1998, Telrad (which replaced its BANN system) in 2003, and more recently, in 2004, the Electricity Company, the 100th SAP client in Israel. Other companies that have implemented SAP include Bezeq, Migdal insurance, the oil refineries, Mizrachi Bank, and more.

After this short history of the Israeli ERP market, the empirical section below will describe the nature and distribution of skills within an implementation team, and will explore what types of knowledge are utilize in the course of implementation work. Instead of following ready-made categories, I will try to map out below how main actors in the SAP ERP implementation field classify the types of knowledge and skills they employ in their daily work.

Findings

The Global Division of Labor and the Composition of Project Teams:

The implementation of ERP systems in Israeli organizations is nested within a global division of labor. The vast majority of client organizations in Israel contract with global implementation companies, which run national branches all over the world, while employing mainly project managers and a few top programmers in each branch. The project managers take an active role in contract negotiation with prospective clients, and after a contract has been signed, start to compose an implementation team. A top manager at the Israeli branch of "ERP International", a leading global implementation company, described the kind of people employed by his branch:

> Our people at ERP Israel have the relevant education. They are accountants, economists, engineering management graduates. These are not typical IT people, but rather people who understand business [the term said in English –A.D.]. [We employ- A.D.] purchasers, operation people who can talk to someone on an equal footing. It is very important in managing the implementation process. Understanding business is important, it is also important to have gray hair, or a bald head, so they will be treated accordingly. Most of our people are non-technical.

This excerpt points to a primary emic distinction, the separation of business and technical knowledge and skills. The global implementation firms employed only older more experienced people with a strong managerial background. After all, these employees will spend most of their time negotiating contract details with the clients' top managers. Following contract signing the project managers try to put together an implementation team which will operate for a year or longer until ERP implementation in the client's plant is complete.

Given the high level of required expertise associated with ERP implementation, composing a project team is not an easy task. The team managers, who are typically employees of a global implementation firm, start to subcontract with smaller and local firms employing ERP implementers and programmers. In addition, the project manager needs to hire freelance consultants, and, mainly in the early years of ERP implementation, global experts. A top manager working for a global ERP implementation company described the sub-contracting system as follows:

> No company has all the people it will need at all times. …so if I need more people I start to look around for them. As a result, you go to someone [a different implementation company] who did not take part in the tender or someone who lost the tender to you and you sign a contract with them about their implementers.

One can wonder why such a sub-contracting system takes place. Why did the global firm employ mainly project managers and not their own implementers? This study can offer two possible answers. The first has to do with the cyclical nature of the ERP market. Transactions in this market are very large in monetary terms, but spread out unevenly along the year. Thus, the global firms, exploiting their ability to sign the most lucrative contracts, transfer the risk associated with long term employment of experts in a highly volatile market to the smaller and local companies. This economic explanation is expressed in the following excerpt from an interview with an experienced implementer:

> This is a sector…with seasons, it all depends on the number of projects we get. You can hire a whole team and fire them when you no longer need them. But I employ only a certain core of people. When necessary I take sub-contractors. A company like "Local ERP" [a small local implementation company – A.D.] doesn't do projects, they sell heads. …That is what they do and it is good business, they make a profit from people. I also sell people on rare occasions.

This excerpt exemplifies the central role of sub contracting in the ERP sector, and how risk is forced down the business hierarchy. Also, note the use of the verb "sell" when talking about the sub-contracting of experts in this field. It is almost as if it is the expertise which is sold rather than the people who move around the market.

The second explanation for the sub-contracting system is related to the contextual nature of much of the knowledge employed by the implementers. Each and every project requires people who know the specific way in which a client organization conducts its work and structures their workflows. In addition, the implementers are required to intimately know the local business system in which the client organization operates. Thus, it is more cost effective to choose the right people for each of the implementation teams by sub-contracting with them rather than offering year long full employment to a very wide range of implementers, to cover all possible implementation projects. Given the combination of local yet highly specialized knowledge and skills required for good implementation work, putting together the right implementation team for a specific job, with all its diversity, is the single most important task of the project manager.

Interestingly, composing a project team is often done with the active agency of the clients. The failure rates of ERP exceeds 50%, and client organizations are well aware of the high risk associated with the implementation project. Partly as a result, some client organizations hire their own experts to guide them through the long and risky process of choosing the right ERP system, and to supervise the lengthy implementation process. Based on the professional advice of the experts they hire, it is not uncommon for client organizations to request that specific experts will be hired by the global implementation firm to become part of the project team. For example, in the case of a leading university in Israel, the client presented the global implementation company with a list of local experts, which they wanted to include in the implementation team. A few of the experts required by the

client had experience with previous ERP implementation in a different Israeli university. This is but one indication of how specialized skill and knowledge are within the ERP field, and how they are attached to specific people. Another example of the active role of clients in putting together an implementation team is from an interview with an experienced project manager:

> There is also horse trading. The teams which are offered by the implementation firms are screened very carefully by the clients. The client conducts detailed inquiries, holds interviews [with suggested project team members –A.D.]. They call previous clients, ask, a really careful screening. Clients also reject certain candidates. They ask: 'change this one, and, this one I'm ready to accept.' At the end the composition [of the project team- A.D.] presented to the client is meaningful, and the choice of the project manager is critical.

The elaborate screening mechanisms employed by the clients are surprising, but can be understood when both the high price of ERP implementation as well as the great impact of the software on central organizational processes are considered. Yet, this excerpt also demonstrates the existence of what Freidson (1970) calls 'imputed expertise', namely the ability of members of an occupational community [ERP implementers in this case] to ascribe varying levels of skills to various co-members.

ERP project teams are often global in terms of their human composition, and this was true particularly in the early days of ERP implementation in Israel. In the second half of the 1990's, integrator teams were composed of experts from all over the world. As one veteran implementer, who in time became a project manager, describes:

> Then, when it all [ERP] started it was a buzzword [said in English – A.D.]. No one knew how it was done. For example, when we did our first project in the Dead Sea, there were no people with experience so they weaved together in the project team an English-Irish expert [sic], and another English person with some experience, and a support person from South Africa, and a German to teach me. Everything was new in 1997. Today, ...we only bring in people according to a specific need, when we don't know a certain new module…The core already exists, there is a lot of knowledge here [in Israel –A.D.], so we bring fewer people from outside.

Based on this excerpt and other interviews, it emerges that in the early years of ERP the implementation teams were global. The basic technical skills and knowledge, such as knowing the different menus and adjustments required for implementation work were located outside of Israel. But within a few years this has changed, and the teams have become more local. In fact, from the early 21th century, Israel has started to export ERP specialists for projects in Europe and the USA. One of the implementers interviewed, described his own career around the year 2000, with the fear of Bug 2000 looming large:

> I took part in the first SAP ERP implementation in Israel, and then I left Israel and started traveling around, since there were so few people in the world with the knowledge of SAP. It was worthwhile and good to sell your knowledge. I first went to Taiwan. From there I was sent to Manila in the Philippines, then to Singapore. I worked in Paris, then back to Israel and England, and them Finland.

This impressive global market where implementation experts frequently move is an indication of the important role of contextual elements in implementation work. The knowledge and skills of the menus and workflows which are required for a successful implementation of SAP ERP is transferred not only by reading formal software documentation, but rather through the shared practice between global experts and local novices. Shared engagement in work practice, as the literature tells us (see Barley and Bechky, 1994), is particularly conducive to the transfer of contextual knowledge. It is interesting to note that even in the case of standard software which is very well documented, some elements of knowledge resist codification and require social engagement and shared practice in order to be transferred. While the terms formal and contextual knowledge provide initial tools to understand ERP work, we need to better understand the emic perceptions of skills and knowledge in ERP implementation. In the following section I describe how project managers, programmers and implementers classify the types of skills and knowledge utilized as part of ERP implementation**.**

Emic Perceptions of Types of Knowledge and Skills in ERP Work:

In the last section we note a basic separation between managerial and technical skills. While people with the former type of skill are directly employed by global implementation teams, the latter are sub-contracted to the project team through local implementation firms and directly in the case of freelance consultants. Yet, the separation between managerial and technical skills does not capture the complexity of implementation work. In fact, when we focus only on the work practice of implementers, the most significant distinction employed by the implementers to make sense of their daily work is between three types of knowledge and skills.

The first type is technical knowledge and skill, which denotes here not actual programming, but an intimate knowledge of the different menus offered by the software and the different workflows which are boxed in it. These computerized workflows are defined by SAP as 'best practice' in the various subject fields which the software covers.

The second type of knowledge and skills is called by my informants simply "content", which is comprised of: A) Extensive knowledge of and experience in a specific subject area such as accounting or HRM; B) An intimate knowledge of and experience in the local Israeli business system; and C) Work experience in the similar sector to the one of the client organization, which provides a better understanding of the existing work practices and the inner politics in the client organization.

The third type is interactive social skills, which, more generally, are most characteristic of the emerging techno-service sector. As the data presented below demonstrates, the interactive social skills required in ERP implementation work are divided by the implementers into three sub-sets: A) The ability to extract technical information from the client through social engagement; B) Persuasion skills; and C) The ability to construct professional trust with the client's key users. Below I demonstrate how this categorization of knowledge and skills is reflected in the interviews with my informants.

One of my informants, a veteran implementer, who is now a top manager at a global implementation firm, described the set of required skills in implementation work, and how the skill composition in Israeli project teams changed over the years:

> In the first wave [of SAP ERP implementation] which started in 1995-6, there were content people and they learned all the computer stuff. They hired accountants, engineers etc, and they trained us abroad, in a school near Brussels, Belgium. The course lasted about a month or a month and a half. Then we returned and worked in the field with people who came from abroad. In the second wave people came with a background of information systems and it was harder to train them.

This interview excerpt points to an emic separation between 'content" and 'computer stuff' in the work practice of implementers. Content denotes here a subject matter to which a specific software module belongs. For example, the HR module represents an attempt by SAP to standardize and then box knowledge and skills from the field Human Resource Management, and to present a large number of workflows as 'best practice'. 'Computer stuff ' here denotes not programming, which is hardly performed within implementation teams, but instead an intimate knowledge of the large variety of menus and computerized workflows offered by the software. Note that in the excerpt the speaker describes two periods in the development of implementation teams. During the first phase, content experts were hired and trained abroad in working with the software. These were people with rich experience in the various content fields and probably with strong social skills developed through their work experience. After their training in Belgium, they engaged in shared practice with experts outside of Israel. In the second stage of the development of project teams, formal education in information technologies took precedence over content, and the speaker sees that as a problem. The reason is that both the subject matter and the social skills required for a successful implementation are much harder to acquire when compared to IT education. The head of a medium sized and local implementation company expressed a similar view when commenting on the composition of a project teams: "The people I would hire, the ones I would like to have as implementers, are not those with a computer background, but with a background of processes. I prefer an accountant with a leaning towards computers than the other way around. "

An experienced ERP implementer, who came from an information systems background, described the two types of knowledge and skills she had to master in order to

become what she perceived as a good implementer: "At the beginning, I was a type of 'top user', I knew less about the way the organization itself worked, and more about the software. But slowly I learned how things work within the [client – A.D.] organization." Here, we see reference to a skill which allows for the understanding of the actual workflows and daily work practice in the client organization. In fact, learning to understand how specific client organizations constructed their workflows proved vital to the success of the implementation process as a whole. As we shall see, the ability to understand how the client works depends on the application of interactive social skills. The head of the implementation department in a small local company describes the type of a person he would like to hire as an implementer by saying "I want someone who knows how to extract the information. This is a quality that some people come with, but it can also be taught".

The interactive social skills had other important roles in implementation work. While ERP implementers were not required to know how to write code, they were required to master both the subject matter and the different menus representing 'best practice' which were offered by the software. This is reflected in the following quote from an interview with an experienced implementer:

> With ERP the kind of people and skills are different. With regular systems [the previous generations of organizational software – A.D.], one needs to read a normal workflow, and capture it within the computer system. This is done by programmers, system analysts etc. …ERP is totally different. It is like medicine, you have a basket of solutions designed by the software producer, and it applies to a collection of workflows which were defined as best practice. There are 100 types of purchasing processes, for example, designed with some built in flexibility. The implementer needs to understand the problem of the client… and to chose out of the collections of workflows something which will fit the client. The type of people needed for this task…are people who know more than computing, who know the system's capabilities and how to tailor a solution to a specific problem. You need knowledge and experience in workflows.

This excerpt is more focused on the work of implementers, and the speaker once again makes a distinction between computing [relating here to in-depth knowledge of the different menus and not to active programming], and practical experience in the relevant field, such as accounting or HR]. But, in addition the speaker relates to the implementers need to "…tailor a solution to a specific problem." Here, the use of medicine as a reference point is powerful since it cuts right to the heart of the problem facing ERP implementers. Implementers perform an act of diagnosis of the client organization, and, like a physician, in order to diagnose they need to extract vital information from the clients' employees. This knowledge, just as in the case of medicine, is highly contextual and local in nature. The real challenge facing the implementer is to understand the "problem", which in reality is the previous workflow in the client organization, in order to customize the SAP ERP menus to fit the specific needs of the client. This aspect of implementation work can be described as

translation: understanding the meaning of local and often chaotic realities of work in the client organization, and transforming them into more structured workflows which could be then re-structured according to an existing and boxed workflow within the software. As studies within Science and Technology Studies teach us (Law and Hassard, 1999), translation involves the application of power and the balancing of social interests. The implementers employ their brokering position between the client and the software and while translating actual work realities into software capabilities, actually convinced the key users in the software superiority. Interestingly, ERP implementers talk about the SAP language and logic and their need to convince the key users to adopt this language and logic.

To perform their important role as translators, the implementer had to master a set of service and social skills which allowed them to extract the vital knowledge and knowhow from key users in the client organization. Importantly, the aim of extracting local information about workflows and administrative logic of the client organization is not to adjust the software to the client's needs but instead to adjust the client to the capabilities of the organizational software.

An important function of the implementers, I claim, is to perform what I will call 'reverse customization'. Customization, by definition, is the adaptation of a product to the specific needs of a client. Here, the emphasis in on the producers' willingness to re-design their product according the client specifications. While the producers and implementers of ERP SAP system maintain that their software is adaptive and highly flexible, they mean within the readymade menus and workflows defined as 'best practice'. In reality they hardly modified any of the menus or workflows boxed within the software. The efforts to convince the potential buyers that SAP ERP encapsulates the most up-to-date work procedures within a wide range of subject areas begins in special promotional events which take place in hotel lobbies even before contract negotiations. But most of the reverse customization is built into the frequent social interaction between the implementer of a specific module and the key user appointed by the client organization. Extraction of vital information from the key user and the act of persuasion of software superiority are intertwined.

Reverse customization requires the implementers to do more than simply learn the ways of the client organization. A major role they play is in convincing the key users to think within the envelope, broad and flexible as it may be, offered by the ERP software. This means that as part of the social and service skill they need to master the art of persuasion. To be convincing the implementers need to present themselves to the clients' key users as experts in their field, to demonstrate an excellent understanding of the existing workflow in the client organizations, to have a very good command of the software, and to be able to persuade the key users that the software solution in indeed superior to the previous way of conducting business. All these skills are intertwined in practice. For example, the presentation of the software options and the effort to convince the client are done simultaneously as part of the interaction between the implementer and the key user. Here is a short quote from an interview with a key user in the HR department of an Israeli university, who was convinced to adapt the SAP way of thinking:

> During the first stage I'm supposed, in HR for example, to know all the work in our [the client organization] department and who one should speak with [when encountering a problem]. I need to know what other departments are connected to the HR department, what applications they might have, and I need to provide this information to the implementation company. I need to provide them with the broad picture. When we start working with the software, I need to understand how it works and to start thinking more in the 'SAP way.'

This interview excerpt provides an indication that the implementers were successful in convincing the key user, who later is responsible to disseminate the SAP knowledge among the other employees in the client's HR department, that she will need to think the 'SAP way'. In reality this means that the users are required to adopt themselves to the software capabilities rather than the other way around.

To sum up, in this paper I identify three important types of skills which the implementers see as central to their work: technical, content and interactive social skills. Implementers and their managers have a developed vocabulary for the required technical skills, and also detailed descriptions of how these skills are learned and transferred. This is also true for the so called 'content' skills, namely an experience in a specific subject matter acquired prior to their employment as implementers through professional training and practice in field such as engineering and accounting. Yet all those involved in ERP implementation find it much harder to discuss the interactional skills which they employ while extracting vital information from key users, convincing them of the superiority of their product, and presenting themselves as experts in their field. Some of the informants describe these skills as qualities that a person either has or doesn't have. Others said that these interactive skills could be learned, but failed to specify how. The difficulty in discussing the required interactional skills is also related to the traditional cultural separation between knowledge and service work which I highlighted at the beginning of this paper. In the daily work practice of the ERP implementers, service and the technical elements are combined as part of social interactions, and together they comprise a distinct set of skills different from the some of their parts. In the discussion section below I discuss some of the implications of the blending together of knowledge and service elements in the work of ERP implementers, seen here as an example of an emerging class of techno-service workers.

Discussion and Conclusions

Our age is an age of rapid digitalization of the socio-economic infrastructure. The computerization of work and leisure blurs the traditional divisions of labor among design, production and sales. Product development and design adjustments are increasingly becoming part of sales and service work. The changing division of labor has important ramifications on the types of skills and knowledge necessary in different lines of work. This paper challenges the traditional separation between knowledge and service work.

One impact of digitalization is the flow of technical experts from the R&D labs and into the service and sales functions, where they customize innovative products according to clients' needs (Darr, 2006). In the case of ERP, we see the central role of expert knowledge in the implementation teams, as 'content' experts engage in 'reverse customization'. As the technical complexity of sales and service increases, I argue, so does the need of so called 'knowledge workers' to depend on interactive social skills. The growing interdependency of social and technical skills is rooted in a shift in advanced economies from sales of a product to sales of a process, and carries important implications for cultural categories, work organization and educational programs. While the separation between knowledge and service work is fundamental to our society, in the daily work of ERP implementers this analytic separation is all but meaningless. As part of technical service and technical sales work, it is becoming impossible to differentiate the two types of skills.

Governments and economic institutions have long tried to measure and quantify types of skills and the complexity of different lines of work. The analytical distinction between technical and social skills underpins some of these attempts. For example, much of the sociological research on the skill levels of different jobs, which is based on the American *Dictionary of Occupational Titles* (*DOT*), combines three main dimensions: complexity in dealing with things, with people, and with data, to create an overall measure of job complexity (Attewell, 1990: 426). Technical skills are associated mainly with the manipulation of things, while social skills are related mostly to the complexity of dealing with people. This basic separation is challenged by the rise of techno-service workers, and might point to a need to re-evaluate the way we classify and quantify our contemporary world of work.

What exactly does the growing inter-dependency of knowledge [or technical] work and service [or sales] work mean? On one level, it means that the service elements and the technical elements of ERP work are not separated in temporal terms, but are instead performed simultaneously. The interactive social skills employed by ERP implementers include the development of what Pacey (1990:146-7) calls a "technological dialogue" with the key users. The creation of such dialogue requires building rapport and professional trust, as well as the interactive exchange of technical, political and social information. The ERP implementers also conduct technological interviews with the key users, in order to extract vital information from them. Here, knowledge and service work are intertwined in temporal terms.

The blurring of boundaries between knowledge and service in the techno-service sector is, in a deeper sense, an indication of the growing penetration of professional work into the heart of the industrial enterprise. The separation of knowledge and service work has historically been supported by work organizations, through the creation of separate departments and a clear division of labor between knowledge and service workers. Yet, this distinction between knowledge and service work has never existed within the professions. In medicine, law and accountancy, this distinction carries little meaning, and professionals will find it very difficult to separate the knowledge and service aspects of their work.

As professionals enter sales and service positions, they carry with them the blending of these two types of skills, which is part and parcel of their long professional socialization. Since organizations, unlike the professions, think with categories which better fit the logic of the industrial era, they find it hard to conceptualise the skills employed by techno-service workers, and to tailor effective training programs for them.

One practical implication of this study is that the enhancement of the *interactive socio-technical skills* of the ERP implementers could greatly improve their chances of success. Formal training which effectively combines technical and service skills is neglected today. Good communication skills could improve knowledge and skill transfer within project team, and between the teams and the key users. ERP Implementers should learn how to manage a *technological interview*, specifically structured to extract vital technological information about the client's organizations. Formal and informal training which require students to confront the growing interdependencies between social and technical skills will support an emphasis on value-added processes and will improve the competitiveness of enterprises in the emerging techno-service sector.

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