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Timing Expertise in Software Development Environments[1]

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In the ICT industry, and particularly in the software sector, knowledge change, the development of expertise and the construction of professionalism are crucial factors for understanding institutional patterns related to professionalisation. This paper draws upon research on professionalisation in the ICT industry conducted in Germany to explore how time regimes regarding innovation, qualification requirements and working time regulations are linked to the structuration of expertise in different organisational settings and correspond to particular and contextual professionalism. Project deadlines play a crucial role in the structuration of expertise as common pattern for IT firms, whereas ongoing education and quality standards integrated into management systems serve to stabilize professionalism in large IT enterprises.

Introduction

Within the practice of software development, local space, social contexts and the acceleration of time are crucial factors that affect definitions of expertise in IT organisations. Software development teams are embedded in complex, interconnected institutional webs, including the technical communities of their peers, related business and technology networks, broader educational institutions or research and development systems and national and international working regulations. Moreover, actual time conceptions regarding work and particularly work forms in the German IT industry are deeply rooted in the professionalisation of different occupational fields, since they involve working time constraints and regulations institutionalized within organisational environments supported by social groups such as professional associations or trade unions. In this paper I argue that qualification requirements and tasks in software production remain more stable regarding time in the core business areas of production and design of standard software products in large enterprises like systems analysis, in which university degrees, especially in computer science are typically required.

Recent research conducted in Germany on working time regulation in the biotechnology and IT fields reveals that regulatory systems have been developed in companies over the years that combine informal rules with formal regulations and institutions. Many employees currently consider the works council as an option for reconciling the existing fissures in the company's trust culture. This research shows that common working-time practice is a source of manifold individual and social causes of conflict depending on the organisation size and specialization of the working force (Fehre/ Melis 2005: 5). The authors argue that the contextual organisational and work-related conditions, as well as the subjective attitudes and action opportunities of employees, determine the regulation practices in organisations.

1 This research was supported by the German Research Foundation (DFG).

In knowledge-based work such as software production, the traditional time-regulation practices based on length, place and division of working time are no longer effective. These flexible and rapidly changing production environments make control and management difficult and require a high level of self-control, also in the area of working time (Ebd.: 7). Customer satisfaction and accomplishment with specific timed project milestones are the most important output parameters for evaluating work effort in the IT sector. Thus, many scholars in Germany talk about the shift in working time control towards an output control (Böhm et al., 2004; Haipeter et al., 2002; Glißmann/ Peters, 2001).

During the late 1980s and 1990s, working time in Germany has generally been a source of flexibility for employers and more recently a means of balancing work and life responsibilities for employees. Nevertheless, no general pattern of working time regulation exists in Germany. According to Berg et al. (2003: 35), the negotiation of flexible workweeks by sector and through plant agreements between labour and management has led to considerable variation in the structure of working time arrangements. According to Boes and Trinks (2006: 32), due to the crisis in the German IT industry, highly qualified IT workers have rejected traditional attitudes against trade union interventions and allowing organisation councils to represent worker interests. Currently, IT workers assign more importance to the articulation of their interests, also in the form of demands regarding working time(Ebd.: 312).

At the organisational level however, managers must have an overview of the general working time reserves or, in other words, the ability of employees to react to new projects, which management systems integrate as quantification of effective working time expressed in target agreements. Decreasing working time control due to demands regarding flexibility in knowledge-based occupations like software development indicates a relaxation of bureaucratic rules in IT organisations. Nevertheless, control mechanisms within IT organisations require redefinition in order to respond to the challenge of learning and coordinating learning capacities while defining and timing innovation goals.

The development of the occupational knowledge base[2] plays a crucial role here, since new practices must be incorporated into working processes and employees must adapt themselves to network innovation requirements. The ability of employees to adapt to flexible work environments is especially important in the Information and Telecommunication (IT) industry, in which the transformation of the working and professional knowledge basis is very fast and innovation cycles differ among different product-oriented firms.

The development of the internet boom during the 1990s was associated with a strong expansion of occupational knowledge and a diversification in its jurisdictional fields[3] in the IT sector. In general terms, the IT sector experienced a sustainable growth during that time which was increased through the diffusion of IT throughout all industrial sectors and convergence between the IT and telecommunications sector. Existing curricula at universities during this period of expansion was not matched to the new skill requirements

2 For Abbott (1988: 8), there are two different forms in which occupational groups control knowledge and skill: One emphasizes technique and the other involves abstract knowledge: *"Here, practical skill grows out of an abstract system of knowledge, and control of the occupation lies in the control of the abstractions that generate the practical techniques. The techniques themselves can be delegated to other workers"*.

3 Abbott (1988: 20) refers to jurisdictions in the following terms: *"The central phenomenon of professional life is thus the link between a profession an its work, a link that I shall call jurisdiction. To analyze professional development is to analyze how this link is created in work, how it is anchored by formal and informal social structure, and how the interplay of jurisdictional links between professions determines the history of the individual professions themselves."*

in the IT sector and therefore, the consequent shortage of workers had to be covered primarily through career changers with heterogeneous qualification backgrounds. Additional strategies to overcome labour shortages in this development phase of the IT sector concentrated on training or retraining existing staff, hiring foreign workers, outsourcing and temporarily hiring less skilled workers (OECD 2002).

The shortage of IT workers during the late 1990s brought about structural changes that influenced the development of professional groups. A first common dynamic of innovation processes in the IT branch was followed by an increasing standardisation of work processes and erosion of jurisdictional stability, the work boundaries of professional groups (Baukrowitz et al. 2000).

Technical developments and the expansion in the IT sector thus precipitated changes in skill requirements. At the same time, they drew many non-qualified users as workers into both the IT sector and the increasingly important IT service sector. The growth of the workforce in the IT sector facilitated the work of highly qualified and experienced IT professionals, who could delegate easy tasks to the newcomers[4] (s. Dostal 2006: 258).

The mismatch between computer science as a discipline and IT practice in Germany is not only due to the capacity of universities and other educational institutions to supply IT engineers, but also the discrepancy between the scope of academic computer science and the rapid development of the IT practice and market demands (Ruiz Ben 2002; Huber et al 2001). Dostal (2006: 206) points out that the recruitment of side-step IT workers[5] has been considered an ideal way to confront both the shortage of IT workers and IT skills. These workers have adapted very quickly to the skills demands in the branch through special courses and at the same time succeeded in incorporating user perspectives[6]. Dostal distinguishes among three types of side-step IT workers: those coming from related occupational fields without training; those from application fields who have received additional training; and unemployed persons who have received a specific training through active labour market measures (Ebd.: 259). These three groups of side-step IT workers would be employed until the subsequent generations of persons studying in the newly established computer curricula[7] could join the IT labour market.

Nonetheless, due to the rapid growth in demand for IT workers, the participation of side-step workers in the IT sector became normal. Paralleling this solution for the workforce shortage in the IT sector during its expansion phase, in August 2000, the German government launched a so/called “Green Card” programme allowing for 20.000 temporary visas for high-qualified computer specialists from outside the EU. Dostal (2006: 251) points out that this political measure was initiated at a time in which the need for IT workers was no more acute. Rather, Dostal highlights the following reasons for the implementation of the green-card action (2006: 251):

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4 Regarding changes in professional boundaries, Abbott (1988: 39) points out: “*A profession is always vulnerable to changes in the objective character of its central tasks. Thus in the immediate postwar period, computer professionals were generally electrical engineers or programming specialists expert in the hardware peculiarities of particular machines. The development of compilers and other forms of fixed software has freed computing professionals to develop rapidly towards the much more open applied software jurisdiction. The development of UNIX and other hardware-impervious operating systems will allow complete emancipation.”*

5 I refer to “Side-step IT workers” as those persons working in the IT branch without university degrees in computer science, but with an autodidactic background in computing.

6 The integration of user perspectives in software development is a long-debated issue in computer science (s. i. e. Constantine/ Lockwood 1999).

7 Neue IT Berufe (s. Dostal 2006: 143).

– As counterbalance to the decline of qualification in some segments of the IT branch caused through the proliferation of workers with a background in the IT dual system (s. Ruiz Ben, Claus 2005).
– Facilitation of offshoring through the development of contacts in the countries of the green-card IT workers.
– Expansion chances in foreign markets in the green-card IT workers´ countries.

In sum, the alternatives to confronting the shortage of workers for the IT sector in the last years in Germany focused on the recruitment of side-step workers and highly qualified, foreign personnel. German computer science graduates represent only a minority within the IT working force. Thus, the professionalisation of computer science through university qualification in informatics is very limited (Dostal 2006: 158). The curricula in educational institutions, and especially in universities, are not designed to respond to the demands of developments in the IT market (Dostal 2006: 259), which has grown parallel to the expansion of software development in almost every industrial sector. As a result, the adaptation of qualifications and skills to IT innovation timing primarily takes place internally in IT organisations with a strong emphasis on certification from large IT corporations. Particularly after the crisis of the IT sector in 2002, corporate training certifications became more important and the sector began to normalise in terms of working force needs.

Professional jurisdictions for computer scientists, especially the field of application development, have not been totally monopolised by any particular group because there is „no undisputed dominance of information technological knowledge“ (Hartmann, 1995, p. 164). Thus to a large extent, the failure to restrict the jurisdictional fields of computer science comprises the reason for „the low professionalisation“ of the sector (Rothenwaldt, 2001, p. 17). Nevertheless, this failure to monopolise the knowledge basis and jurisdictions is not homogeneous mostly due to divergences in innovation timing.

Areas in which the knowledge basis is more stable, such as system or data base development, differ from those like application areas, in which change occurs rapidly. These two areas are complementary since software applications are based on more complex system software created and monopolised in large enterprises. Due to the mutual endorsement of organisations in IT networks, the internal dynamic of knowledge development in the network must be coordinated and incorporated into the working practices of the participant organisations. At this point, workers must be able to learn new practices and unlearn those that have become obsolete. Both learning and unlearning are inscribed in the process of knowledge creation that structures professionalism in some sequences of time. From the point of view of learning organisations, many scholars have researched how organisations are able to manage the dynamic of explicit and tacit knowledge development and the relations to the environment (Argyris/ Schön (1978); March/ Olsen 1975; Nonanka/ Takeguchi 1995; Dierkes/ Alexis/ Berthoin Antal/ Hedberg/ Pawlovsky/ Stopford/ Vanderstein (2001)). Thus, I distinguish between three timing levels related to the evolution of software development environments.

First, I analyse the level of the workaday, situated expertise dynamic of software development projects that are controlled through project-time schedule restrictions (deadlines).

Second, I examine the organisational level, defining institutionalized expertise (professionalism) by considering potential expertise that the organisation can mobilize within the network to acquire and develop future projects on the scope of its negotiated innovation visions. At this level, I distinguish between two important dimensions: simultaneity and synchronisation. Simultaneity refers to our view of the different projects

that take place at one time, whereas synchronisation refers to both the coordination of running projects and scope of future projects. It is also important to consider the history of organisations as a kind of recording or organisational memory that gives identity to the organisation and serves as reference point for future plans (s. i. e. Walsh/ Ungson 1991; March 1991; Schein 1985; Martin 1992). Especially in ICT enterprises and in relation to the growing internationalization of the sector, consulting firms play a crucial role in the practice of storage and scoping the identity of the organisation in a global economy.

Third, I turn to the macro level in which the innovation timing[8] of networks is (un)-connected[9] to the development of qualifications and education of new generations of IT workers. Baumol (2002) argues that large firms use innovations as the main competition weapon. However, due to innovation costs and obsolescence risks, firms use the sale of technology licenses and participation in technology sharing so that innovation becomes routine.

Different time regulations and expertise norms correspond to the size, specialisation, scope and innovation patterns of organisations, but also to the customers´ characteristics and their extent of contact to developers. Customer contact[10] in large enterprises that develop standard software is usually not the jurisdiction of the software developers, but of personnel specialized in public relations and management. In contrast, in smaller firms specialized in the adaptation of standard software to particular customer demands, multitasking is very common and software developers combine their software adaptation activities with direct contact to their customers (normally end-users of the software-adapted products). Software developers in these smaller firms must react more quickly to the changing demands of the customers than workers engaged in the production of standard software. Thus, qualification requirements and tasks in software production remain more stable concerning time in the core business areas of production and design of standard software products in large enterprises such as systems analysis, in which university degrees, especially in computer science are generally required. These core areas use discursively institutionalized rules and resources like strongly formalized internal, continuous qualification measures to support expertise development and correspond to slower product innovation cycles. Some analyses of the requirements for IT specialists in German software companies in 2001 show that 48% of the vacancies were reserved for university graduates, whereas 37% were for candidates from polytechnics (Fachhochschulen) in the fields of software development, systems analysis and databases. According to microcensus data for the year 2000 in Germany, 58% of workers in the software and database fields were university graduates (Licht et al. 2002: 66 f.). Nevertheless according to Dostal (2000), two thirds of the IT workforce were side-step workers who obtained their IT qualifications in official IT programmes that have existed since 1997. These qualifications were primarily required in the peripheral fields of the IT branch. According to the classification of CDI[11], these are the IT core tasks II (IT Kernberufe II) that include IT organisation, IT consulting or IT service and support. They differ from the IT core tasks I (IT Kernberufe I) (Software development, system analysis, databases) in which university graduates, particularly in computer science, are in demand. Additional skills, such as the ability for team or independent work, are required for both fields, but willingness is especially important for core tasks I. Core tasks II attaches more importance

8 Baumol (2002) argues that large firms use innovations as their main weapon for competition. Due, however, to innovation costs and obsolescence risks, firms use the sale of technology licenses and participation in technology sharing, so that innovation becomes routine.

9 Unconnected in the sense of the aforementioned mismatch between the development of curricula in computer science and the knowledge-based development in the IT sector.

10 Customers of standard software producers are often firms from other industrial sectors and are not end-users of the software products themselves.

11 CDI Consulting GmBH (http://194.69.36.7/cdi/).

to analytical thinking (CDI 2002: 7).

Innovation risks regarding to customer and to the end-user acceptance of new products[12] is crucial for the development of software products, particularly when accounting for the increasing importance of system integration and the individually adaptable solutions of companies (CDI 2002: 9). Nonetheless, analysing the acceptance of new products is integrated into company structures in different ways, depending on their size and specialisation area of production. In larger and medium-size enterprises with more specialised structures, this expertise is delegated to specialists in marketing, whereas in small enterprises this aspect is also the responsibility of developers (Berndes et al. 2002). Moreover, smaller networked enterprises increasingly take over the adaptation of products to customer perspectives and must react rapidly to market dynamics and customer preferences. In these enterprises, qualification requirements and tasks change very quickly and respond to tacit and dynamically established rules. Especially in application areas of the software industry, which have very short innovation cycles, tasks are associated with flexibility and creativity, requirements common for workers in other service sectors that characterize them as a creative economy[13].

Regarding working time in the "creative economy," Florida (2002) comments: "*In the creative economy, time is the only non-renewable resource. The three big factors driving this economy, along with the need for creativity, are the prevalence for change, the need for flexibility and the importance of speed."* In the ICT sector, in which highly dynamic software development areas interact with more stable areas like system development that require slower innovation cycles, time also represents a non-renewable resource. This resource is crucial for coordinating expertise, professionalism and innovation patterns.. Networks play a synchronisation role here (Rammert 2000a).

In my view, time regulations in networked organisational settings constitute a differentiation factor for expertise and professionalisation patterns. To support this thesis, I use empirical results of from research conducted in Germany on the professionalisation of computer science. The paper is structured in three sections. In the first section, I use Giddens´ structuration theory to analyse how expertise is structured in software development and how it is related to particular institutional settings. In this section, I also explain the characteristics and methodology of the research. In the second section, I refer to the structuration of time according to different definitions of expertise that are based on the empirical results mentioned above. Finally, I explain how expertise, standardisation and knowledge transfer are linked to each other. In sum, I show how time concepts in different areas of software development work as relational and multidimensional factors that influence standardisation patterns of knowledge and working practices, as well as professionalisation and the institutionalisation of expertise and innovation.

The Structuration of Expertise in software development

Giddens´ structuration theory attempts to draw together two principal strands of social thinking: the structuralist, with its main focus on structure as constraining factor, and the

12 Also resistance from several environmental sources towards new products must be considered at this point. Nakamura (2000: 19) argues: *"Opposition to new products can arise from consumer and political groups, from workers who make rival products within or outside the firm, or from potential distributors. This opposition may be formal or informal, legal or illegal."*

13 Howkins (2001) argues that we should think of the new economy as being built around the "creative industries," which he defines as the sectors of the economy controlled by one of the four kinds of Intellectual Property law: patents, copyrights, trademarks and designs.

phenomenological and hermeneutic traditions, which emphasize human agency. Structuration theory conceptualizes both perspectives (structure and human agency) as mutually dependent or, in other words, as a recursive duality. Structuration theory has been used in numerous studies of information and communication technologies and organisations (DeSanctis and Poole 1994, Walsham 1993, Yates and Orlikowski 1992, Orlikowski 1992, Orlikowski and Baroudi 1991, Klein and Myers 1999).

The work of Orlikowski has been especially enlightening. Orlikowski has developed a structurational model of technology that links institutional factors, human agents and technologies. In her conceptualization, human agency constitutes technology and simultaneously contributes to constituting human agency or, interaction. Some authors however, such as Jones (1997), argue that this conceptualization is not compatible with Giddens´ structuration theory because structure in Giddens´ terms exists only in memory traces and agency represents a human attribute that cannot be reified in material artefacts. Agency exists only in the minds of human beings[14].

Following Walsham (2001: 8) however, I contend that computer-based information systems embody interpretative schemes, provide coordination and control facilities and encapsulate norms. Thus, computer-based information systems are deeply linked to rules of behaviour, systems of meaning and forms of power relations actualized in interactions and crystallizing in institutions along a time-space continuum. Structuration theory suggests that both human action and institutional properties constitute social reality and that social systems are produced and reproduced by human actors using rules and resources in interaction. Structure includes both rules and resources and is both *"the medium and the outcome of the conduct it recursively organises: the structural properties of social systems do not exist outside of action but are chronically implicated in its production and reproduction"* (Giddens, 1984, p 374). Thus, according to Orlikowski and Robey *"…structure and action constitute each other recursively"* (2001, p.147).

Following this concept I define expertise as a structural principle in organisations that, depending on their extension in different contexts, can be defined as institution. I argue that institutionalized expertise can be captured in habits such as documentation practices, which remain momentaneously coded in large IT organisations and networks. IT networks here play a coordination and synchronisation role admitting different innovation timing (Rammert, 2000a: 12).

Thus, expertise can also be structured in network- and organisation-related working time practices and regulations, and through project-related time norms (deadlines). These practices become both routinised and constitute a rule for the software developers´ work. At the same time, software developers draw on these within their ongoing interactions. In software development projects, project team members negotiate practices adapt them to new clients´ demands on the basis of previous project experiences. This influences the constitution of expertise, or in other words the transformation of structural principles. Rules of expertise do not have to be explicitly captured with the practice of documentation, as they are in large organisations, . Instead, they are implicitly followed by software developers, which is the case in organisations operating in short time innovation cycles. In these organisations, meeting deadlines constitutes the main rule that defines expertise. Deadlines are first negotiated between organisation managers and customers. These deadlines constitute "authoritative resources" for organisation managers and consultants and are related to the synchronisation dimension of expertise development at the

14 *"Structure exist only as memory traces, the organic basis of human knowledgeability, and is instanciated in action"* (Giddens 1984 pp 377).

organisational level (s. p. 6 above). At the same time, deadlines represent shared norms of behaviour for the persons working on a project.

Orlikowski and Yates (2003) point out that organisational members´ everyday communications and work shape their experiences of time while their communications and work practices are at the same time, recursively structured by the shared temporal norms and expectations of the members. Crucial at this point are communication patterns, since they lie at the nexus of the relationship between time and work (Ballard and Seibold, 2003). Ballard and Seibold (2003) distinguish between two dimensions of temporality of working practices: a Temporal Enactment dimension referring to how workers perform time through regularized patterns of behaviour reflected in such attributes as duration, sequence, pace, and rhythm and captured by objective time-measure factors. And Temporal Construal as the way workers experience or orient to time. This second dimension can be manifested in temporal parameters such as temporal horizon (long vs. short term), temporal orientation (past, present and future), and experience of time as scarce, dull, slow, and urgent. Thus, while Temporal Enactment emphasizes objective and quantitative features of time, the Temporal Construal refers to subjective and qualitative aspects of time related to work practices.

I would suggest that temporal norms and regulations are related to working practices, but also to project deadlines (as temporal enactment dimension) as essential links to customers in software development and thus constitute important dimensions of expertise definition. Moreover, from the temporal construal perspective of working practices in software development it is important to emphasize the influence of gender. As I point out elsewhere (Ruiz Ben 2006), expertise definition in software development environments is influenced by a social-technical divide that is linked to the working conditions and work-life balance opportunities in different organizational contexts. The relevance of continuing education (also as a form of structuring and institutionalising expertise and moreover professionalism), especially in the "technical areas" of an environment with extreme time pressures, and the lack of family-friendly politics, especially in smaller companies (in the majority in Germany) contribute to the crystallization of gendered expertise and professionalism patterns. Moreover, those areas more heavily coded as technical are seen as more work- and time-intensive. They are also expected to be less "women friendly".

In addition, the diverse relationships among project time management, quality standards and external and internal consulting practices in different organisations that compose ICT networks influence the differentiation of expertise in ICT networks and reflect the necessity of negotiating technical standards between different actors (Rammert, 2000a: 10). I therefore consider different "time regimes" that shape definitions of expertise linked to qualifications, continuous learning and skill demands. Time regimes are linked to the gendered patterns of expertise and professionalism definition, since they differently structure time orientations of men and women in ICT organisations and networks and serve as different orientation for both men and women[15]. Time regimes are also closely related to commercial pressures to reduce "time to market" and involve disparate forms of regulating time norms and resources at various levels of the ICT production. Time regimes thus represent crucial structuring principles in Giddens´ (1984: p. 6) sense. Flexibility related to time, location, and the development of skills constitutes an additional factor that defines expertise for short time cycle innovative software development organisations. There is no time for standardisation or for career or professional projects, both from the perspective of organisations and "creative workers," in my case, software developers. One of the reasons

15 It is important to emphasize here also the interrelation of gender with other social categories such as age or qualification. (s. McCall 2001 on the interrelation of gender, class and race in the new economy).

why “creative workers” work overtime is because they are intrinsically motivated and like their work (Florida 2002: 148; Pongratz and Voß 2003; Voß 1998; Wagner 2000). From my point of view, this kind of work motivation, along with self-management, also constitutes important elements that structure expertise related to working practices in different organisational settings. These elements are part of the skills expected of software developers, particularly in less formalized and regulated organisational environments.

In the next section I explain the methodology used in a project carried out in Germany on the professionalisation of computer science that constitutes the empirical basis for my arguments.

Research methodology

Our[16] study PROFI (Professionalisation of computer science –Chance for the enrolment of women?, financed by the DFG) (Ruiz Ben 2005, 2006a, 2006b), conducted at the Institute of Informatics and Society (University of Freiburg), drew on Abbot’s theoretical approach to the analysis of professions and explored the construction of gendered meanings within this dynamic. We wanted to examine the professionalisation process of software development in Germany and the chances for women’s enrolment in this process. Abbott (1988: 19) focuses on the control of work as the factor that brings the professions into conflict with each other and makes them interdependent. According to Abbott, both external and internal factors precipitate professional transformation. External factors include benefiting from the acquisition of new jurisdictions and destruction of old ones, which leads to the weakening of the jurisdiction of other professions. The second source of change comes from internal factors initiated through the development of new knowledge within the dynamic structures of professions. In this process workers acquire skills through educational achievement and attainment of educational certifications recognized in the jurisdictional field. Professions therefore have a structured path for their potential employees, since they define and construct the skill requirements in their jurisdictional fields.

I considered the interaction between the corpus of knowledge defined as belonging to a professional field, the construction of expertise in organisational contexts and the creation and maintenance of systems of values and power within professional jurisdictions as critical to understanding professionalisation in software development in Germany. Professionalism constitutes the institutionalized form of expertise in professionalisation processes [17] and the link between different timed innovation rhythms within the IT sector[18] (s. p. 6). Alternate forms of professionalism are, according to Abbott (ebd.), commodification and organisation. In the ICT sector today however, building organisations, and particularly connecting networks, occupational identities through project-timing play a crucial role in defining professionalism. At this level and based upon structuration theory, I argue that

16 The research project was funded by the DFG and was conducted by Prof. Dr. Britta Schinzel, Isabel Reiff, Dr. Esther Ruiz Ben und Raphaela Swadosch. The results of the research have been recently published a. o. in Ruiz Ben (2006).

17 Regarding the reasons why professionalism exists Abbott (1988: 323 ff.) argues that *“our market-based occupational structure favors employment based on personally held resources, whether of knowledge or of wealth. (…). We have professionalism, secondly, because nearly all kinds of knowledge are organizable as common resources for a body of individuals. (…) We have professionalism, third, because competing forms of institutionalization have not yet overwhelmed it.”*

18 (s. p. 6),

professionalism and expertise constitute each other recursively in organisations (s. p. 11 above).

In the recent literature on the sociology of professions (Dubar 2000; Evetts 2003; Fournier 1999; Gadea 2003), research has focused on how workers themselves use the discourse of professionalism as well as managers in order to discipline workers and workforces via mechanisms of occupational identity and self -control. The use of a professionalism discourse is also an important aspect of professionalism for better understanding the time dimension of expertise in the ICT sector. In this paper however, I consider professionalism as institutionalized expertise in some areas of ICT production that remain more stable, such as systems analysis or those closer to the production of standards (Ruiz Ben 2005). Professional associations and large ICT organisations are important actors in this process,[19] since they support and legitimate the jurisdictional claims of these "elite groups" that are also directly involved in establishing technical standards. Therefore, understanding the definition of professionalism within the software industry and the transformation of expertise requirements in IT organisations is crucial for analysing professionalisation patterns and constitutes the main framework of our research.

Sample Basis

The study was based on open interviews with 13 female and 17 male software developers. Furthermore, we wanted to analyse the perspective of academic experts as well as recruiters in IT organisations. For this purpose, we interviewed professors of computer science (2 women and 4 men) and personnel managers in software enterprises (3 women and 9 men). Regarding the characteristics of the enterprises, we chose a balanced number of software companies of varying size (1. Firms with less than 50 employees; 2. Firms with more than 50 and less than 1000 employees; 3. Firms with more than 1000 employees) in different areas of software development (Software system development; Quality security systems; ICT architecture; ICT Consulting; Media Design; Software for Hardware Development) The diversity of ICT firms in our sample regarding size and production area represents a very important aspect related to the research goal of analysing professionalization trends in the ICT branch. The interviews were conducted between the end of 2000 and 2001. Due to the favourable moment in the ICT branch in that period of time, the access to the firms and the willingness of the interviewed to take part in our research was very positive.

The interviewed persons were contacted in conferences, through personal contacts or by telephone. Through these first contacted persons we came in touch with additional candidates for interviews. We tried to get a balanced number of women and men for each group of interviewed persons, nevertheless this was not possible, which is particularly remarkable for the group composed by personnel managers.
We recorded the interviews at the workplace during the working time. The interviews took in average approximately 90 minutes.

The methodology was distilled from the theoretical corpus of Meuser & Nagel (1991). These authors define experts as individuals who are (a) somehow responsible for a draft, the implementation or the control of a problem solution or who have (b) privileged access

19 Abbott (1988: 153) points out that "*when jurisdiction is contested in public media or the courts, professional associations can easily dominate. But when the battle must be fought by isolated groups of salaried professionals enmeshed in large organizations, an association´s ability to control its turf decreases sharply.*"

to information about groups of persons or decision processes (Meuser and Nagel 1991, p. 443).

We used an open, semi-structured questionnaire that focused on thematic blocks and reflected the perspective of the three groups of experts (academic experts, personnel managers and software developers in IT organisations). The block relating to professionalism included questions about the meaning, status, and variation of professionalism and expertise in the different organisational settings; about the required qualifications, set of skills, experience, grade of specialisation and deficits of the software developers; and about the relation between education and practice in educational institutions. In the following section, I present some of the empirical findings of our survey regarding time and expertise obtained from the interviews with software developers and personnel managers in software enterprises.

Expertise, standardisation and time synchronisation

Expertise is one of the key elements for establishing working patterns in IT companies. Expertise is however, differently related to standard internationally recognized production norms[20] in the IT industry (Ruiz Ben 2007). In this section we explain how expertise, standardisation and innovation cycles are related to each other through time and innovation concepts. Expertise refers to contextual and institutionalised practices and norms that both explicitly and implicitly combine knowledge in organisational settings. Standardised production patterns established through internationally recognized standardisation organisations like the ISO run parallel to these contextual practices, as do those developed internally within large enterprises, which are forwarded to networked companies[21]. The software developers as well as the personnel managers that we interviewed in large- and medium-size enterprises emphasized that these production norms constitute quality control for both products and production practices and serve as a legitimating basis both internally (within the network to control expertise and production procedures) and externally for negotiation practices with customers. At the same time, they differentiate between – in the words of the software developers -– a *"declarative level"* of communication with the customers, in which they have to adapt to project-oriented rules and organisational standards (sometimes related to international recognized standards such as ISO), and a *"praxis-related"* level in which they communicate with other project team members. This *"praxis-related"* level refers to the workaday practices within the software development team that are not shown to customers. Different timings correspond to the two levels: the "declarative" level is oriented towards the project deadline and on the "praxis-oriented" level, several module deadlines must be synchronised according to the "project deadline". From the point of view of software developers, on the one hand, time threatens software quality for concrete projects. On the other, and from a long term perspective, it threatens

20 Quality initiatives such as Six Sigma serve as a tool to implement existing quality standards defined by ISO using data and statistical analysis in order to measure business processes, recruiting and outcomes. Principally, Six Sigma represents the practical realisation of the Total Quality Management approach. The main philosophy of this tool is to define and identify defects as failures in relation to customers´ demands. Network organizations must however, find a previous consensus regarding customers groups and moreover, innovation, quality and performance goals. Once these goals, as well as coordinative and regulative standards are integrated within quality management systems, they serve as a legitimization basis for network performance.

21 For an overview about legitimacy regarding standardization in ICT environments s. Werle and Iversen (2006). Promoting Legitimacy in Technical Standardization. In: STI Studies, Vol 2., March, 19-39.

future projects because time pressure requires the an extreme reduction of documentation. As a software developer puts it:

For me it is personally like that, that the time aspect today has so high a value that other aspects remain lost. So, for instance to store the information somewhere for everyone, to maintain this information in an updated form, also to document as much as possible, and such processes in which many things are described. And also situations in which information about technical aspects of the project should be maintained. All this is sacrificed. And it has disadvantages for the future, when you need to use this information. 30330

Standardisation and quality control require long-term perspectives that characterize innovation patterns of the organisations using these norms. Particularly for the qualification of the employees in organisations working in international teams[22], standard quality measures and their embedded time concepts function as shared norms to coordinate the teams. In contrast to this pattern, in companies focused on adapting standard software products to customer needs, work must be flexibly scheduled according to short-term customer requirements. Documentation or quality standards do not regulate work practices. Time flexibility is thus structured and institutionalised in these kind of organisations through tacitly established rules and the intrinsic motivation of the employees. As I discuss below: employees must have the ability to shape their working time on their own.

Expertise, qualification and skills requirements related to innovation

Especially smaller and middle-size companies working on software application development rather than system development are open to applicants from diverse professional fields. This includes, in particular, persons with professional experience strongly associated with a non-specifically defined "technical know-how" in the words of personnel managers. This recruiting policy is further justified with reference to the autodidactic abilities of applicants, which facilitate adaptation in a rapidly changing context. Moreover, personnel managers comment that a degree in computer science does not suffice to meet other requirements, such as maintaining good customer relations and assessing applications. In addition, the personnel managers of smaller companies stress employees´ individual abilities, the positive "character traits" of their employees, which hardly have anything to do with skills gained in training or particular formalized qualifications. Besides flexibility and self-discipline, the ability to work independently is one major asset expected from candidates. It is important for smaller companies, which dominate the IT sector in Germany (BMBF, IESE 2001),[23] to meet customer demands because here individual software and customised software solutions are produced. These small companies are primarily characterised by flat hierarchies, fixed-term projects and enormous time pressure and competition. Flexibility,[24] in terms of the pressure to work over-time, is the largely self-imposed norm in these firms. The employees of such

22 S. also Ruiz Ben (2006c).

23 BMBF: Bundesministerium für Bildung und Forschung (Ministery of Education); IESE: Fraunhofer Institute für experimentelles Software Engineering (Research Institute that belongs to the Fraunhofer Society).

24 Flexibility can be understood in general terms as a group of political and economic processes aimed at improved adaptation of the workforce to market demands. Flexibility affects several dimensions of labour relationships and processes such as working time, work location, wages or work organization. Regarding this issue in relation to the new economy s. e.g. "Flexibility and the New Economy" Chris Benner (2002): Work in the New Economy. Flexible Labor Markets in Silicon Valley, Oxford 2002.

companies – on average not older than 30 years – are described as some kind of "individualistic" workforce or in the words of Sennet (1998: 10): "Employees are required to be flexible, to adapt to last-minute changes, to permanently take risks and to be less dependent on regulations and formal procedures". References to those "flexible" norms also show up in our interviews, especially in the discourse of personnel managers in small companies. But flexibility is essentially determined through the strict accomplishment of deadlines. Meeting deadlines constitutes the most important factor in maintaining customer satisfaction and hence a crucial quality factor. As a personnel manager in a small company puts it:

Professionalism, I think, always has something to do with quality that as it is known it is very difficult to realize and to measure (…) for us it has different facets. I think that the most important is customer satisfaction, and the customer is satisfied if the project is ready in the time allotted and within the accorded budget. 20081

In large software companies working under time pressure is also an important expertise factor that software developers do not learn at universities, but in practice. As a personnel manager points out:

How does one want to learn it at university? Time pressure? Yes, he experiences time pressure related to the work he has to deliver to the professor or so. This is not the same. 20110

It is therefore important that software developers learn to self-manage their working time schedule and adapt to the routine of time pressure as an individual fate, taken for granted as part of "a new basic form of work" (see Baukrowitz et al. 2000: 11). The self-management of working time can be seen as a kind of "internalized schema," a concept Sewell (1992) adapts from Bourdieu, according to which employees contribute to the structuration of expertise: The pressure to achieve does not stem directly from management, but indirectly from peers and customers. The interests of employers "slip into employees´ heads" and constitute a well-functioning organisational domination system. In Giddens´ terms we can speak of a structure of domination (Orlikowski, 1992: 405). Professionalism however, also possesses a dynamic character; it changes according to the dynamic of the consumer market, to which organisations must remain sensitive as they translate ideas into new products.

Continuous learning is one of the factors that organisations use to bind innovation times. In large IT companies, continuous learning and internal qualification paths[25] are strongly formalised according to the company's policies for innovation. Thus, company managers formulate general innovation goals that the personnel managers translate into concrete aims to be transferred to the employees in the form of agreements about individual qualification paths. Employees must regularly participate in qualification measures determined through innovation plans.

Qualification time sequences, that means the negotiated qualification goals and trajectories that the employees should reach within a given period of time, are also formally prescribed in the employees´ work contracts. Depending on their specialisation level, the employees can move among different IT areas or even IT-related areas of the company. Personnel managers welcome internal mobility in particular, referring to the employees' "personal development" rather than "career development." The personnel managers we

25 Qualification paths in terms of continuous learning in the large IT organizations of our sample are organised according to the innovation goals and general management strategy of the company. Using this criterion, they define different qualification modules that they offer to their employees. Some modules have a general character, whereas others are more specialized depending on knowledge requirements in specific job families.

interviewed in large IT companies indicate that employees are very satisfied with this innovation-oriented "personal development" and that only few employees show career ambitions to attain management positions.

Expertise, innovation cycles and knowledge management

The identification of consumer market trends, or in the words of a personnel manager "the Softwarezeitgeist", is one of the aspects that is increasingly becoming a part of the expertise requirements in software development. Nonetheless, this aspect is integrated differently in company structures depending on their size and production scope. In larger and medium enterprises with a more specialized structure, this aspect of expertise is delegated to marketing specialists. As Abbot argues *"Multiprofessional firms in accounting, information and architecture (…) elaborate professional bureaucracies in engineering and law, all encode professional knowledge in the structures of organization themselves"* (Abbott 1988: 325).

Large IT companies can build such professional bureaucracies, also related to marketing, because their products are more stable on time. In other words, the lifecycle of IT products from large enterprises are longer. In small enterprises, an awareness of market trends comprises an additional responsibility for software developers themselves (Berndes 2002). These different forms of appraising signals from the market are of special importance for software development due to the rapid and dynamic replacement of knowledge in the branch. Knowledge management must be sufficiently flexible to allow persistent adaptation. Abbott cites continuing education and career turnover as the two responses to this rapid change of knowledge (Abbott 1988: 180). The acquisition of young employees - particularly in companies characterized by very short innovation cycles - is also an adaptation strategy in many software enterprises (Berndes et al. 2002).

Flexibility, as mentioned above, also represents a very important factor for software developers in terms of the need for adaptation to the typical changes in client requirements and consequently, specifications. Software developers referred to this as a "moving target." They related it to the need for persistent adaptation to reality that in most cases fell very far away from systematic planning, which is also influenced by the time pressure in the projects: *"(…) it starts very often, mainly because of time pressure, with the implementation of something and then we change it every time because the requirements change or because we did not consider some requirements (…)"* (software developer) Furthermore, regarding deficits in expertise, software developers referred to usability aspects, such as the integration of customers and end-users into the development process in order to develop more qualitatively user friendly products: *"I would say that the user should have a higher importance regarding software usability. (…) You should include him in the whole process (…)"* (software developer).

Some institutionalised practices for knowledge transfer and work control, for example documentation, are used in large and medium enterprises but usually not small companies. The absence of documentation practices corresponds to especially acute time pressure in small enterprises. In our interviews software developers working in large enterprises paid much attention to the importance of the documentation for the practice of software development. They specifically referred to the need for data modelling as a very important concept: *"it is unprofessional when people think that they can easily write a program without building a concept (…). In a professional context this is impossible and also a poor documentation (…)"* (software developer). *"Not thinking about what the system should do*

at the end, that´s the standard error. Not taking the time to design the business-model tidily is the worst mistake you always make." (software developer). Although documentation does not always work in practice as intended (s. p. 10), it constitutes a structural property of particular organisations that structures expertise and time rules.

Conclusions

In this article I have shown how expertise is timed in German IT organisations and how it is related to professionalism and time regimes. Organisational time regimes in German IT companies differ in particular according to company size and the kind of software products they produce. Time regimes play an important role in the way IT organisations link expertise, continuous learning and skill demands differently, as well as the way in which they react to commercial pressures to reduce "time to market". Specifically, the relationship to consumer market pressures constitutes a differentiation factor among IT firms of different sizes and with different production aims (standard software / application software). At the same time, the relation to consumer market pressures represents an important factor for understanding the relationship between IT firms producing standard software with longer lifecycles and IT firms rapidly reacting to consumer market signals that adapt standard software products to the customer perspectives.

For the latter group of IT firms, working time flexibility is a key factor for surviving market dynamics. Networks of IT firms of different sizes synchronise innovation rhythms. Nonetheless, networks must take into account not only synchronisation among firms, but also the working time regulations existing at the national and international level. In Germany, there is a Federal statute governing working time/hours, overtime and out-of-hours work. Individual arrangements pertaining to these issues can be set forth in employment contracts, provided they do not violate statutory provisions. In the IT industry in Germany working time does not represent an acute area of conflict, although in recent years, since the crisis of the new economy affected the IT industry especially in 2003 , working time demands have increasingly become a source of growing individual conflicts (Fehler/ Mehler 2005) and an increasingly claim factor for IT workers (Boes/ Trinks 2006).

"Organisational time regimes" refers to innovation timing, employees´ qualification biographies and working time regulations. "Expertise definition" is related to qualification and skills demands, as well as working practices. These aspects are differently structured according to the structural properties of organisational environments to which time regimes belong. I have shown that in large software companies dedicated to the production of standard software, quality standards and formalized qualification paths and working time regulations are important dimensions of their time regimes alongside project-oriented deadlines. In smaller software companies in software application areas, time regimes are not related to widely recognized standards or formalized qualification paths, but to ad-hoc rules emerging within projects. The accomplishment of project-oriented deadlines constitutes, in these kinds of organisational settings, the main structural property in Giddens´ sense (s. p. 12 above) contributing to institutionalised expertise. Temporality in work practices in the software development environments considered in this paper, shows both a structural (deadlines) or in terms of Ballard and Seibold´s (2003) an enactment dimension, but also a interpretive or following Ballard and Seibold´s (2003) terminology a construal dimension. To this construal dimension belong aspects such as the long term orientation of the employees and their possibilities to balance project work with continuous

training. Linked to this is the mentioned "personal development" preferred by the personnel managers in our interviews, to which software developers have to orient themselves. Thus, software developers have to combine their project work with their continuous training that often it is not provided in the organisations, in order to remain included in the fast changing ICT labour market[26]. Nonetheless, the implicit risk of this aspect is that, as Powell (2001: 57) remarks: *"Employees forced to transfer their talent from project to project, however, also find they can move readily from employer to employer."*. This possibility to move from one firm to another implies also that employees orient themselves rather to professional groups than to the firm itself. Mobility is however, closed related to the situation at the ICT labour market. Thus, due to the crisis of the ICT sector after 2003 and the pressure linked to ICT offshoring, ICT employees tend to opt for stability at the workplace (Boes and Trinks 2006). Moreover, in large organisations, employees are encouraged to engage in internal continuous training that often are very specialized for the organizations´ needs, leading to a dependence to internal mobility in the corporation (Dostal 2006: 268).

As I suggest elsewhere (Ruiz Ben 2006), and drawing on Abbott´s arguments concerning alternatives to professionalism, professional knowledge is encoded in the structures of organisations as an alternative to structuring expertise (Abbott 1988: 325). Currently, the closure sequences of certain areas of software development in IT organisations imply an interaction between work synchronisation and the definition of expertise.

The scope of the research presented in this article is limited to a particular time sequence in the professionalisation process of computer science and contextualized within the situation of Germany. This precludes a generalization of the data discussed. A longitudinal study would be necessary for this purpose. Moreover, for further research would have to take into account the growing importance of off- and nearshore processes in the framework of an increasing internationalisation of the German IT industry in a global economy. Intensification of working time and a more complex synchronisation of work make the role of project and quality managers indispensable. Moreover, ICT consultants play increasingly a crucial role shaping innovation timing and professionalization, since they support the establishment of cooperative networks with customers and collaborators. The internal and external dilemmas of the synchronisation of time regimes are however, still unexplored. The analysis of the institutionalisation of expertise and professionalism in global software environments from a long-term perspective taking into account the importance of different time regimes would help to better understand professionalisation processes and related inequalities in the IT industry from a national as well as an international point of view.

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26 Particularly women and elderly employees are affected by biography discontinuities in the ICT branch (Ruiz Ben 2006).

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