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Low-Skill Industrial Work

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1 Introduction

This paper reflects on the development prospects of 'simple' industrial labour in advanced societies. The term 'simple labour' denotes tasks of low complexity that make no great demands on employees and require only limited qualifications to perform. One can also speak of 'low-skill industrial work'. For quite some time, mainstream research has been of the opinion that the permanent trend of upgrading of skills makes this type of work increasingly irrelevant for the development of gainful employment in advanced societies. Consequently, low-skill industrial labour has been seen to become a more and more negligible factor in the course of globalisation because the production processes needing it are increasingly being relocated to developing countries.

This paper will challenge these mainstream perspectives. The thesis put forward is that in specific constellations, low-skill industrial work has the prospect of a relatively stable development also in advanced economies such as those of the EU. The fact that it may represent a promising development path of labour in developed economies has so far been overlooked in research. There are no systematic studies on this topic, but there is distinct empirical evidence in favour of this thesis. The paper takes a closer look at these aspects. Empirically, it is based on the reinterpretation of research findings of an European research project called PILOT that focused on the development prospects of small and medium-sized enterprises from mature especially non-research-intensive industrial sectors in nine European countries.[1] Furthermore, it outlines first conceptual considerations from a recently started research project about the development prospects of low-skill industrial work.[2]

The paper covers the following points: Firstly, important aspects of the social science discussion on the future of low-skill work are outlined. Secondly, empirical research findings on the organisational patterns of low-skill industrial labour and on company personnel policy and training measures are presented. Thirdly, company innovation strategies as one of the main determining factors for the existence of low-skill work will be outlined. And finally, the notion of simple labour is stated more precisely in a conceptual perspective.

[1] The research project 'Policy and Innovation in Low-Tech Industries in Europe – PILOT' was conducted from mid-2003 to end-2005 and was funded by the EU FP 5 (see www.pilot-project.org). The main findings are summarised in Hirsch-Kreinsen/Jacobson/Robertson (2006) and Hirsch-Kreinsen (2008).

[2] This project started in May 2008 and is being conducted at the Chair of Economic and Industrial Sociology, TU Dortmund (see www.einfacharbeit.de).

2 The debate on the development of work

When summarising the social-science debate on trends in the evolution of industrial work in the developed West-European countries, it is particularly worth emphasising the discussion surrounding the consequences of globalisation and the development of the international division of labour. This discussion is strongly influenced by export-trade theory as well as by product life-cycle theory. According to the latter, labour-intensive industrial sectors and industries manufacturing mature and standardised products are subject to a long-term trend of relocation to low-wage countries (for a summary see Fagerberg, 2005). Even if one momentarily disregards the methodological problems of establishing a clear relation between international investments and domestic employment evolution, these views should nonetheless still be differentiated in several respects:

- Firstly, the balance of foreign direct investments and the related relocation of production sites in no way exhibit congruent tendencies. For example, newer data from Germany show that companies shifting production sites are characterised by a high proportion of on-the-job-trained and/or untrained workers manufacturing 'technologically mature' products. However the data also show that technologically more demanding products and processes are increasingly being relocated (Dachs et al., 2006; Kinkel et al., 2007).
- Secondly, it should not be overlooked that changes in the international division of labour and with it job development are inseparably linked with the development and growth of international value chains. 'New Trade Theory' in particular points to this aspect – highly dynamic value chains interlace enterprises of different technological levels from very different countries – which makes it nearly impossible to accurately predict enterprise (re)location and its effects on jobs (e.g. Faust et al., 2004).
- Thirdly, one also has to note the more recent debate on the increasing significance of industrial clusters for the economic development of older industrialised countries (e.g. prominently Porter, 1998, 2000). This debate reveals (e.g. Braczyk et al., 1998; Heidenreich, 2007) that these are by no means only agglomerations of high-tech sectors and firms, but also include technologically more mature companies which make use of simple and labour-intensive processes. As becomes evident from a whole series of examples, such enterprises can durably secure the viability of their production sites and secure jobs even in highly industrialised countries due to their participation in clusters (e.g. Maskell, 1998; Maskell et al., 2006).

Of further interest is also the discussion surrounding the emerging 'post-industrial society' and 'knowledge society' which focuses on the structural change of work (cf. Drucker, 1994; Stehr, 1994; Willke 1998): For one thing, the accelerating process of the tertiarisation of economic structures and employment since the end of the 1970s is emphasized. The research findings show, however, that this process can under no circumstances be characterised as 'de-industrialisation'. Rather the development in modern societies is very often characterized by a progressive interconnection of goods and services production and the industrial sectors can be regarded as the 'driving force' of this economic development (for a summary see Baethge/Wilkens, 2001). For another thing, the long-term trend towards generally higher qualification requirements and the increasing importance of knowledge-intensive occupations is at the centre of interest. No doubt, low-skill economic activities have become less important. Data for Germany show that simple production activities diminished considerably in the period between 1995 and 2000, by c. 2.4 million jobs (Weidig et al., 1999; Dostal, 2005). But at the same time these assumptions about macro trends should be differentiated, as is indicated by the prognosis for developments in Germany: It forecasts a differentiated decrease in simple work, and anticipates that by 2010 almost 30% of all gainfully employed persons will still fall into this work category (Weidig et al., 1999; Dostal/Reinberg, 1999).

The findings of the aforementioned PILOT project also offer a differentiated view on the future of simple industrial labour in the advanced societies of Europe. Firstly, this study demonstrates the surprisingly important role such enterprises have played up to the present day (cf. Kaloudis et al., 2005). According to 2005 data on the EU 15 countries, mature industries account, roughly speaking, for over 60 percent of employment in the whole manufacturing sector.[3] Secondly, the results of this study show that this concerns enterprises whose work processes are largely based on low-skilled labour. In the following section, these findings will be described in more detail.

3 Patterns of low-skill industrial work

3.1 Remarks on methodology

The analysis of the PILOT project is based on 43 case studies of mature industrial enterprises in nine EU countries. Typical examples of mature industries are the manufacture of household appliances, the food industry, the paper, publishing and print industry, the wood and furniture industry and the manufac-

[3] Own approximation based on: OECD Science, Technology and Industry Scoreboard 2005, Annex A, p.183; Eurostat Database 2005.

ture of metal products – such as the foundry industry – as well as the manufacture of plastic products. Many of the activities in the steel, chemical and automobile industries also fit the criteria. Following well-known approaches to characterising industrial sectors with regard to their international development paths and innovativeness such as “product-life-cycle theory” (Vernon, 1966), attempts to measure R&D intensities of different industries (cf. Smith, 2005) as well as the results of the aforementioned PILOT project (cf. Hirsch-Kreinsen et al., 2006; Hirsch-Kreinsen, 2008), mature industries can be defined as follows:

- Firstly, these sectors have gone through an evolution which resulted in the emergence of recognised standards, methods, and knowledge related both to products and processes, i.e. they are characterized by established technologies and regimes of production.
- Secondly, mature industries in this sense are by and large low-tech or medium-low-tech industries in terms of the well-known OECD classification (cf. Hatzichronoglou, 1997), that is to say they spend less than 3 percent of turnover on R&D.
- Thirdly, a consequence of the established character of technologies is that incremental technological change is prevalent. Radical innovations based on fundamentally new scientific findings or erratic shifts in buyers’ preferences can happen but are an unusual event in mature sectors. This applies both to products and processes. Connected with this are relatively low growth rates.

Within this broad sector, about half of the case-study enterprises of the PILOT project were chosen from the sector of metal processing, and the other half from the sectors food-processing, textile and clothing, print, wood products and paper manufacture. The case-study enterprises had to have at least 40 employees and had to have been economically successful. In general, the sample primarily included small- and medium-sized enterprises (SMEs), reflecting the fact that the mature industrial sector in Europe is dominated by firms of this size (CIS, 2004: p. 40). To permit comparability of the investigation results, the common methodological basis of all the case studies was a standardised questionnaire and a structured interview guideline. The standardised questionnaire collected basic data on the enterprises: product and process structures, personnel structures, and customer and cooperative relations. The structured interview guideline was used to conduct around half a dozen interviews per case study with company specialists. These interviews were supplemented by a company tour and analysis of accessible company documents. The main research questions centred around the skills, qualifications, work force and work organisation that predominate in mature enterprises. The two main dimensions of the

analysis of the enterprises were, on the one hand, the organisation of work in the production department, and on the other, the related personnel policies.

The line of argument in the following draws strongly on the the work of Klaus Schmierl, Tobias Kämpf and Holm-Detlev Köhler, who delved into this research question within the scope of the PILOT project (cf. Schmierl et al., 2004; Schmierl/Koehler, 2005; for a summary see Bender, 2006).

3.2 The organisation of work

At first glance one cannot find a clear-cut pattern of work organisation and qualification levels in the examined mature industrial enterprises. This heterogeneous segment of the economy is characterised by various types of work organisation. Its form is determined by an interplay of many different factors such as product complexity, types of machinery and automation in use, personnel policy, the market situation, quality requirements and customer demands. In some cases, different forms of work organisation are in use within one company. Thus a simplistic definition of mature firms and their work organisation as dominated by unskilled labour, a very high degree of labour division and strict hierarchies, is not supported by our data. At second glance however, one can identify two prevailing patterns of work organisation:

(1) A first pattern can be described as the clear predominance of a 'traditional Taylorist' work organisation. Its main characteristics are a high degree of labour division, a heavily specialised workforce and sophisticated hierarchic levels. Furthermore, there is a strict separation of, on the one hand, conception, planning, steering and regulating functions conducted in technical offices, and on the other hand, the subsequent production taking place on the shop-floor, characterised by predominantly repetitive tasks and low-level worker qualifications and skills. Typical repetitive activities are, for instance, the running and servicing of machines, the insertion of materials on automated lines and standardised assembly tasks. From our sample of case studies, nearly all companies from the food sector were found to be making strong use of the traditional Taylorist, hierarchic type of work organisation. More than half of the metalworking companies investigated belong to this (idealised) type too, as well as some companies producing wood products and furniture. Examples for this type of work are simple assembly and packing work or the monitoring of activities on automatic lines. Altogether this pattern of work organisation was found in more than half of the mature enterprises studied.

(2) A second pattern can be characterised as a less formalised, more open and flexible organisation of work. On the one hand the division of tasks between pre-production planning and manufacturing departments is maintained. On the other hand limited functions in terms of disposition have been shifted to

production and to the executive personnel on the shop floor. In these cases the usual strict division between responsibilities of the actual production personnel and the production planning and scheduling department is reduced. More operational manufacturing-related decision processes are integrated into the work itself. That is to say that the concrete planning of the work sequence and deadline management is often done by the workers on the shop floor themselves or in consultation with their supervisors. Furthermore, the horizontal division between individual jobs and persons employed is not so strictly regulated in these firms. The division of responsibilities between the individual jobs, as well as the employment of personnel within the production area, is flexible and depends on the temporal and material requirements of job orders. In other words, the workers on the shop floor must be able to rotate between quite different job functions consisting of simple tasks. Provisionally, this type of work organisation can be called 'Semi- or Flexible Taylorism'. This type of work organisation is found in a smaller number of metalworking firms, as well as in the textile industry, the food processing, wood products and furniture sectors. Typical examples of work organised according to this pattern are such basic tasks as monitoring, machine-running and assembly activities which, in contrast to the first-mentioned organisation pattern, are, however, much opener and more flexibly structured.

In addition to these two patterns of Taylorist work organisation in companies, attempts at more autonomous, 'non-Taylorist' forms of work organisation, intended to enhance flexibility and shorten reaction times, were found in some cases. This form of work organisation was introduced in order to place more responsibility on all shop floor workers and to achieve flexibility, rotation and skill diversification. A strict direct allocation of the individual workers to specialised working stations is abandoned in favour of individual worker and group responsibility for broader work tasks. A group can consist of workers with different, or quite homogenous qualifications on a high-skill level. The shop floor groups have a certain amount of responsibility for the scheduling, steering and regulation of the whole immediate production process as well as for machine maintenance and for quality control. This form of work organisation can be mostly found in companies in the paper industry which use automated process routines largely decoupled from human labour.

In some cases production processes are segmented. Routine phases are followed by critical segments requiring relatively great skill and multiple forms of knowledge, and these again are followed by unproblematic segments. Consequently the process segments differ remarkably in both the implemented technology and equipment and the type of work organisation: phases of traditional 'factory work' are followed by highly automated, 'clean' processes, while subsequent steps may be dominated by manual

work again. It is very difficult to say whether in these cases a ‘modern’ overall process is being interrupted by ‘traditional’ episodes, or the other way round.

3.3 Personnel policy

At first glance skill levels too are heterogeneous. Though there are companies that employ mainly cheap, unskilled labour, in other cases qualified workers’ knowledge and capability was identified as crucial to company success. Thus it would be wrong to see a general decline in the relevance of blue-collar knowledge to the efficiency of production in mature companies. However this is not a technical matter only, but also one of subjectivity and tradition. The prevailing patterns of personnel policy and training can not always be clearly traced to the above-sketched pattern of work organisation. A closer look reveals however, that the personnel policy is mainly characterised by a short-term, hire-and-fire policy, recruitment on the external labour market (cf. Schmierl/Köhler, 2005: 198ff.). The identified patterns of personnel policy can be specified more precisely as follows:

(1) Many firms have a personnel policy which can be termed ‘non-systematic muddling-through’. In these companies routine processes dominate, the production process is standardised and mature, product characteristics do not vary substantially and no particular technological or organisational changes are necessary. In these companies knowledge of the relevant production process is mainly the domain of specialist engineers, master craftsmen (foremen) and skilled workers. Specialist engineers come from a variety of academic backgrounds including mechanical, chemical, and electronic engineers, as well as sector specialists in textiles, paper, or wood. This non-systematic pattern seems to dominate in the companies investigated in the furniture and textile industries and in labour-intensive sections of the food sector. In some food sector enterprises mostly unskilled workers are employed in production segments where their knowledge is not crucial to the company’s success. This is reflected in the fact that the shop floor workers are fairly interchangeable, and temporary work as well as forms of part-time work are common practice. As a result, on-the-job training too only plays a subordinate role. These companies offer no systematic continuous training. For practical jobs a basic school education and an extremely short familiarisation are sufficient. A certain furniture company claims the whole production process could be run at the same efficiency level within three months if the whole production staff (except for supervisory personnel) were replaced by a new workforce. In some companies permanent efforts were identified to replace human productive knowledge (incorporated in skilled craftsmen) by increased use of embodied knowledge. An example for this is one German manufacturer of swivel

chairs who predominantly employs semi-skilled workers, as the production process requires no elaborate skills.

(2) Other firms in the sample pursue a personnel policy that relies heavily on internal training, usually on a more or less ad-hoc basis at the workplace during daily working hours. This pattern of personnel policy and training can be termed 'incremental internal on-the-job training'. This is the 'usual' way of familiarising new workers with their specific tasks and of enhancing the level of skills in production in mature companies, and therefore the forms of on-the-job training are permanent features of their personnel policy. The importance of experience-based practical knowledge[4] in the firms investigated makes internal on-the-job training the first choice. It is often organised as the transfer of knowledge from older to younger employees. Knowledge acquisition in mature firms often takes the form of experimental learning-by-doing, trial-and-error processes, with results that are rarely documented. The dominance of internal training also reflects the deficiencies of vocational training systems in many countries. Although schooling has provided shop floor workers with basic production knowledge, in many interviews it was highlighted that specific knowledge of production activities can only be acquired through long-term work for the company. In some firms this results in little formal documentation and personnel policies that encourage worker permanence, thus a large reserve of knowledge accumulated in learning-by-doing phases is secured and transmitted from seniors to new recruits. As a welcome side effect, staff members are strongly bound to the company because of low demand for their specific qualification or skill profiles in other companies or sectors. This is a result of the internal training activities described but often also of weak or lacking national educational and vocational training systems able to supply sought-after skills and qualifications.

By contrast, some of the companies investigated prefer to hire qualified personnel, not so much because of their qualifications as such, but because of their professional attitude towards work. A skilled workforce is considered more cooperative, reliable and loyal and thus less likely to cause disciplinary problems or conflicts. Hence, in a smaller number of companies personnel policies which may be termed 'advanced' could be identified. These include participation, polyvalent use of labour, support of long-term labour relations, and strategically planned, on-going modification of work organisation and process technology.

[4] The term 'practical knowledge' stands for a complex bundle of different knowledge elements that comprises explicit, codified and formalised elements. Similar correlations are indicated by Nonaka/Takeuchi's (1997: 70) category 'operational knowledge', which describes the process of integration ('internalisation') of explicit and codified knowledge into ongoing operating processes that are strongly characterised by tacit knowledge.

As to the question of a general tendency, it should be emphasised that the bulk of the firms in the sample tends to concentrate strategic knowledge and skills in a relatively small group of managers and technical staff, while the production workers are more or less unskilled executors. Thus the firms generally do not deviate from the Taylorist path. However, there is a growing number of enterprises that are introducing new modes of communication and organisational routines such as cross-functional work groups, problem-solving groups, continuous improvement schemes and the like, in order to exploit staff knowledge and abilities more comprehensively. In other words, the type of 'Semi-Taylorism' is becoming more widespread.

4 Company strategies

Here the question arises, which conditions affect these prevailing developmental paths of simple industrial labour? On the basis of our research findings the following aspects can be emphasised: Its concrete form is determined by an interplay of several different factors such as product complexity, types of machinery and automation in use, personnel policy, the market situation, quality requirements and customer demands. The spectrum of these different factors of influence can be narrowed down to the aspect of the innovation strategy pursued by the enterprises. It can be assumed that each company strategy bundles these different external and internal factors.

Following Whitley (2000: 865), innovation strategies are understood as combinations of enterprises' preferences, activities and capabilities for generating and diffusing varied kinds of innovation. The term "technological innovations" is broadly defined in the tradition of the socio-scientific debate on innovation tracing back to Schumpeter (e.g. OECD, 2002; Fagerberg, 2005). Innovation is accordingly perceived as an activity which includes research and development activities, the development and successful marketing of new products, the introduction of new production technologies as well as the reorganisation of processes. Innovation strategies reflect contrasting approaches to dealing with technological uncertainties and market demands. The differences in innovation strategies are more or less closely linked with the companies' knowledge base, staff and organisational capabilities and the institutional environment. To put this in more empirical terms, on the one hand, the term 'strategy' reflects management decision-making processes and the various actors inside and outside an enterprise influencing it. On the other hand, technological, organisational and environmental conditions impinge upon decision-making. In other words, management decisions can be regarded as the 'driving force' behind innovation

strategies, they also reflect the enterprise's internal and external structure, particularly its traditions, power constellations, organisation structures and former 'technological trajectories', which constitute constraints on, but also new opportunities for decision-making.

The stabilisation and the partial flexibilisation of the predominant Taylorist work structures are both a precondition for and consequence of the innovation strategies pursued by the enterprises. These strategies can be briefly defined as follows:

(1) A first innovation strategy is characterised by the continuous further development of existing products. In this case, individual product components are improved and changed as regards their material, function and quality, but the structure and technological principles of the products remain unchanged. This innovation strategy can be called *step-by-step* product development. Typically this concerns enterprises manufacturing products for relatively stable market segments, such as special components for the automotive industry. The products are more or less technologically mature and of low complexity. The process technologies employed in these cases often remain unchanged for longer periods of time and are at the most gradually adapted to changed product requirements. Nearly half of the analysed mature enterprises more or less pursue this innovation strategy. Generally, these enterprises belong to the industrial subsector 'fabricated metal products'; some others belong to the subsector 'wood products & furniture'. More generally, this innovation strategy can be regarded as typical of industrial sectors with mature technologies and products. Their markets are well-defined, their products well-established and often standardised; production technology is efficient and the price of products is a main factor in competition.

In such established production systems, change is costly. For the organisation of work and assignment of personnel, this entails a pronounced orientation towards well-established models, i.e. the preservation of the long-existing Taylorist structures with their standardised and simple activities. Despite the mature and little innovative character of their products, the situation of the enterprises highlighted here proves surprisingly stable, particularly also in view of the competition from low-cost countries. The preconditions for this are: first of all, a production geared to special applications which is often not worthwhile for competitors; secondly a location close to important customers, which makes fast and reliable deliveries possible; and thirdly, the above-outlined form of work organisation, by means of which personnel expenditures and thus production costs can be limited altogether.

(2) A second innovation strategy that could be identified is characterised by innovation measures directed at securing and improving the sales market situation of the enterprise. This strategy can be

called *customer-oriented strategy*. It includes the fashion-oriented design of products, the functional and technical upgrading of products, rapid response to changing customer wishes, exploitation of market niches, skillful branding strategies and the expansion of product-related service activities. The production process and organisation must therefore reconcile the opposing requirements of cost-efficiency and flexibility. This succeeds partially in the companies that combine Taylorist forms of work with elastic production and logistics techniques. In many cases, however, these requirements can only be met by a work organisation corresponding to the Semi-Taylorist type, which enables relatively low-qualified workers to perform a whole range of jobs comprising simple routines.

The enterprises pursuing this strategy, unlike those using the first type, belong to a relatively broad range of industrial subsectors. Examples for this strategy are work processes in the textile and clothing industries as well as furniture and leather-goods manufacturers whose product development is geared to anticipating fashion cycles and whose existing product lines demand a more or less continuous variation. A further example is an office furniture manufacturer who at very short notice accepted an express order from a big market-dominating retailer for a large amount of office furniture of a new, not previously produced type, and correspondingly diversified his products. Accordingly, factory-trained workers needed to be deployed on assembly and packing lines with maximum flexibility. In various cases, a broadening of the spectrum of offers was also observable, as companies supplemented their process functions with service and logistics offers tailored to specific customers. With regard to the empirical findings, such direct and specifically customer-related innovation activities are gaining in importance in at least a third of the companies investigated.

Thus the conditions for stability of this strategy, and the related form of work organisation, can now be pinpointed: proximity to markets and customers, fast and reliable delivery, and at the same time, relatively economical products. One expert interviewed made the point that because of the companies´ flexible delivery capacities, the products of such companies could be priced slightly higher than competitor products from China or elsewhere.

By contrast, ‘non-Taylorist’ forms of work organisation are mostly implemented in companies pursuing an innovation strategy which can be called *process specialisation.* This strategy is deployed by a number of companies whose innovation efforts mainly involve their technical and organisational process structures and who in part utilise ultramodern, automated and capital-intensive process technologies. The necessity of operating these sophisticated manufacturing technologies trouble-free almost inevitably calls for a qualification-oriented form of work organisation with maximal freedom of decision for

workers on the shop floor of these firms. Certainly this strategy cannot be regarded as typical for the sample of the examined mature enterprises.

5 Discussion

Now the question arises: To which extent are the findings of the empirical research outlined above compatible with the hitherto prevailing understanding of industrial work in the sociological analysis of work? Mainstream research in this field equates the cases of simple work described with Taylorist work. This is equally true for German research in the sociology of work (cf. Kratzer/Sauer, 2005) as well as for French (cf. Lallement, 2007) and Anglo-Saxon studies (cf. Rubery/Grimshaw, 2003; Ackroyd et al., 2005). Essential to this understanding of Taylorist work is the direct equation of the main analytic dimensions of work: a low level of functional demand on workers is regarded as being accompanied by low-level or non-existent temporal and material job autonomy and a very low qualification level. Accordingly, work is generally classified along the dichotomy of Taylorist/non-Taylorist. A pertinent question is whether this equation of simple work with Taylorist organisation forms is generally applicable, as seems to be commonly assumed. The Semi-Taylorist type of work organisation described above indicates that this is not so. Although the employees in this case perform standardised, rather low-demanding work, they must sometimes operate with great temporal and functional flexibility to be able to respond to fluctuating job-orders by means of independent planning and job rotation. At the same time, they are required to maintain and continuously improve production quality. In other words, despite their low level of functional requirements, these activities are characterised by a certain measure of autonomous organisation. As the findings show, the significance of this form of flexible but simple work is increasing, and is often even a necessary condition for maintaining the production sites of the companies in question.

Conceptually speaking, a decoupling of the different dimensions of work must be assumed in these cases. In order to be able to grasp and analyse the different forms of work adequately, our research draws on a simple two-dimensional matrix. The two dimensions of the matrix refer to the basic attributes of the classic labor process theory: complexity and autonomy of work (Adler, 2007: 1313). For this analysis, these key-dimensions were specified as follows (cf. Hirschhorn/Mokray, 1992: 39):

- Complexity relates to the functional skill requirements, that can vary between high and low. These functional skill requirements follow from the respective technical-organisational structure of the work

process and the corresponding technical and functional level of the job requirements. As a rule, a low level of skill requirements is accompanied by a high degree of job-fragmentation and functional specialisation and vice versa.

- Autonomy relates to the potential of temporal and functional flexibility which enables the enterprise to respond to fluctuating job-orders by means of independent planning and job rotation. In a very simplified manner, this analysis also differentiates between a high and low degree of work autonomy. A high degree of autonomy is generally associated with a limited degree of hierarchical division of labour and of management control and vice versa.

On the basis of such a two-dimensional analysis, the analytically unsatisfactory dichotomy between Taylorist und non-Taylorist patterns of work can be overcome and alternative development paths of work can be detected more precisely than in the past (see table). This is, however, a first conceptual approximation that still needs to be further specified.

Table: Typology of industrial work

	Low level of autonomy	High level of autonomy
High level of skill requirements	(Polarised pattern of work organisation)	(Integrated pattern of work organisation)
Low level of skill requirements	Taylorist work organisation	Semi-Taylorist work organisation

With regard to low-skilled industrial work, the two forms of work as described above can be defined as follows:

- First, the traditional *Taylorist pattern of work organisation* which features a high division of labour, a heavily specialised workforce and sophisticated hierarchy levels. Moreover, there is a strict separation of, on the one hand, conception, planning, steering and control, which is carried out in the technical offices,

and, on the other hand, the subsequent execution, that takes place on the shop-floor.The latter is characterised by a high share of repetitive worktasks and a low level of qualifications and skills.

- Second, the *Semi-Taylorist pattern of work organisation*: Here, the division of labour between pre-production planning departments and manufacturing has been reduced and functions in terms of disposition have been shifted towards the production personnel. While the functional skills requirements are generally low, the skill requirements concerning planning and communicating capabilities are higher than in the first pattern.

At a higher level of functional skill requirements, further typical patterns of work organisation can be differentiated, but these are not up for detailed discussion here. Briefly, one of these is a pattern that can be called *polarised work organisation*. Here, the division of labour between pre-production planning departments and manufacturing has been maintained. However, limited functions in terms of disposition have been shifted to production, but these functions continue to be limited to the ranks of executive productive personnel such as group leaders or foremen. Moreover, while the skill requirements of the productive workforce are little differentiated, the overall level of skill requirements is nonetheless high. Another pattern of work organisation that can be identified can be referred to as *integrated pattern of work organisation*. In addition to its high level of functional skill requirements it is characterised by a rather wide leeway – in terms of decision-making and organisation of the labour process – for the workers. Characteristic of this pattern of work organisation are the manifold forms of semi-autonomous group work.

Regarding low-skill work, especially the Semi-Tayloristic pattern of work organisation is of particular importance, as it represents a development variant of conventional Taylorist work that has asserted itself in many industrial sectors in recent years. Especially the debate on the changing forms of industrial work organisation in the automotive industry since the end-1990s stands out in this context. According to all available findings, these forms can less and less be subsumed under the dichotomy Taylorist vs. non-Taylorist. This is instructively shown by analyses of the Toyota Production Systems (cf. Adler et al., 1993; 1999). In contrast to traditional forms of Taylorist work, this pattern of work organisation is characterised on the one hand by a high degree of functional specialisation and routine and, on the other hand, by extra-functional tasks of innovation and quality assurance as well as a flexibilisation of the processes. Adler et al. (1999: 64) refer to this pattern as “enabling bureaucracy“. This type of work organisation comprises a bureaucratic core with highly routinised tasks and a second level of additional tasks that have to be carried out autonomously. Like the pattern of the Semi-Taylorist work-organisation

in the examined mature enterprises described above, this pattern aims as much at effeciency as at flexibility of the processes.

Given the current status of analysis, the following question remains unanswered: Which additional conditions have to be fulfilled regarding the organisation and human resources so that the pattern of Semi-Taylorist work organisation can prove to be durably functional and stable? For its Taylorist basic structures make it susceptible to falling back into solely routinised and more unflexible work processes. As is shown by the analyses of the Toyota Production Systems, this can be prevented by means of consistent motivation measures and continuous training of the workers. Furthermore, these studies show that a changed leadership style is the key precondition for the persistence of this organisation pattern (ibid.: 65). Most notably, there is always a risk of the lower-level managers slipping back into more traditional ways in their relations with subordinates and thus of relegating them to their accustomed unflexible routines.

6 Conclusion: Development prospects

Finally, it should be emphasised that in spite of the doubtlessly difficult economic situation of mature industries – the challenges of globalisation and growing competition on world markets – prospects for these companies with prevailing patterns of Taylorist or Semi-Taylorist work organisation are not at all bad, even in countries with advanced economies. This is so for a number of reasons:

- Firstly, the specific innovative capabilities which many mature companies possess cannot easily be copied by potential competitors. As shown, these capabilities exist despite specific patterns of work organisation and the prevalence of simple labour on the shop floor. Paradoxically this applies in particular to standardised products which are usually considered easy to imitate. But such products are often design-intensive, have major potentials for technological upgrading via the use of knowledge inputs and are produced for specialised market segments.
- Secondly, the geographical and social proximity to sales markets and specific customer groups, as well as the capabilities of many mature companies to use and influence these advantages in a flexible manner, are a further important reason for the relatively favourable development prospects of such companies. For low-cost competitors from other countries on the other hand, it is often time-

consuming and difficult to establish the necessary contacts and gain the information needed to enter these markets.

- Thirdly, a considerable number of these companies are obviously in a position to employ high-tech technologies and components systematically and efficiently. Their specific innovative capabilities for one thing, and frequently also their well-established contacts to the developers of such technologies, form the basis for this achievement. Quite evidently the high-tech environment is a central requirement for the development prospects of mature enterprises.

These considerations can further our understanding of the restructuring of the economic landscape of Europe in the first years of the 21st century. The economy does not appear – as stated in the concept of the emerging knowledge society – to be undergoing a wholesale structural replacement of 'old' sectors with 'new' ones, or a substitution of 'low-skill' with 'high-skill' labour. In fact this process of change is evolving as a restructuring – a transformation more from within than from without – of sectoral and technological systems. It is not dominated by industrial activities in which competitive advantage, capability formation and economic change are generated by front-line technological and scientific knowledge. Rather, it is dominated by what are known as mature industries based on more or less Taylorist patterns of work organisation. Moreover, this paper only analysed a section of the industrial sector, viz. technologically mature small and medium-sized enterprises. The majority of them have Taylorist or Semi-Taylorist forms of industrial work. However, it can be assumed that one comes across these work forms in certain fields in technologically newer high-tech industrial sectors, too. A typical example are the production processes in communication technology companies which manufacture mobile phones, the same goes for the assembly of IT-systems or of complex motor vehicles. As shown particularly by the aforementioned example of the Toyota Production Systems, the work processes here in many cases comprise simple tasks which are performed by semi-skilled labour. From this it follows that, all in all, the industrial work forms discussed here continue to be widely-used in the developed European societies to this day and evince a high degree of stability.

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