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Labour Market Effects of International Fragmentation of Production; Evidence from a Survey and Case Studies in the Dutch Industry

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Ebel Berghuis and Frank A.G. den Butter[a]

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Abstract

In this era of globalisation the traditional Ricardian theory of trade in products governed by comparative advantages is replaced by a modern theory of trade in tasks. Tasks are outsourced to those places in the world where the lower production costs outweigh the additional transaction costs associated with coordinating the tasks. The labour market consequences of this outsourcing of tasks is a major concern, both for the country that outsources tasks and for the country to which tasks are outsourced. This paper discusses the labour market effects of outsourcing in the Netherlands using a survey amongst human research officers and in depth-interviews with the strategic management of seven industrial companies. The interviews and survey make clear that a major motive for outsourcing is to organise production in such a way that total production costs are minimized. Total production costs consist of sheer production costs – transformation costs as coined in the theory of transaction cost economics – and of transaction costs. Improved skills to reduce transaction costs may enhance the fragmentation of production. In such cases more outsourcing requires more coordination but the reduction of transformation costs due to producing at a cheap location outweigh the increase in transaction costs so that total production costs fall and productivity increases. However, it brings about a change in the composition of jobs in the outsourcing country: more workers are engaged in R&D activities but less workers are engaged in remaining transformation activities and more workers have transaction jobs. The net effect on total employment is uncertain, but our survey and interviews show that outsourcing should not necessarily be associated with a loss of jobs. Obviously the shift in the nature of tasks among transformation workers and from transformation workers to transaction workers requires other types of skills.

Keywords: Globalization, labour market, transformation jobs, transaction jobs, outsourcing, managing transaction costs, new institutional economics.

JEL-codes: F14, J21, J24, L23, M11.

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1. **Introduction**

A major characteristic of this era of globalisation is the ongoing trend of international specialisation of labour. More and more tasks, such as production of specific parts and components, or provision of specific services, are split from the production process and outsourced to those places in the world where these tasks can be fulfilled at lowest costs. This specialisation exploits worldwide comparative advantages with respect to differences in skills, and in skill levels. The traditional Ricardian theory of international trade governed by comparative advantages in making and trading products is replaced by a theory of *trade in tasks* as Grossman and Rossi-Hansberg (2006, 2008) argue.

Obviously this process of ongoing specialisation has major consequences for labour markets, both in the countries where production is organised and where certain tasks are outsourced, and in countries to which tasks are outsourced This paper investigates these consequences of outsourcing and shifting of parts of the production process abroad for the Netherlands using a survey amongst personnel managers and in depth-interviews with the strategic management of seven industrial companies. The Netherlands can be characterized as a typical "transaction economy" with a focus on organising production. The idea is that such transaction economy has comparative advantages in reducing the transaction costs which international outsourcing bring about. It has been calculated that in transaction economies like the Netherlands, transaction costs may amount to up to 50% of total value added. Therefore, the entrepreneurial ability and skill of keeping transaction costs low is vital for the competitive position of firms in economies which specialize in the organization of production and in combining the various tasks rather than in executing one of the tasks themselves (see Antràs and Rossi Hansberg, 2009). In other words the specific entrepreneurial skill is to manage the transaction costs in this era of globalization (Den Butter, 2012). We label it *transaction management*. Transaction management is about creating value in the organization of production by keeping transaction costs as low as possible. It is determinant for the strategic decisions on where and how to locate parts of the production process: the "make or buy" and location decision. Transaction management is based on modern theories of transaction cost economics, institutional economics, industrial organization and international trade. (Williamson, 1975, 1998, 2000; Ménard and Shirley, 2005).

However, not much knowledge is yet available on how entrepreneurs may use the prescriptions of transaction management, resulting from the economic theories mentioned above, in practical situations of economic decision making in their companies. A companion paper of ours (Berghuis and Den Butter 2013) provides some evidence on how companies manage transaction costs in the international organization of production by making their "make or buy" and location decisions. This paper provides complementary evidence by looking at the arguments for outsourcing from the perspective of the labour market. Outsourcing has consequences for the labour market in the sense that it may lead to losses of jobs for those workers engaged in sheer production – *transformation workers* as we coin it following Wallis and North (1988) – and to gains of jobs for those engaged in organizing production and in managing transaction costs – the *transaction workers.* The net effect on total employment is uncertain, but our survey and interviews show that outsourcing should not necessarily be associated with a loss of jobs. Obviously the shift from transformation workers to transaction workers requires other types of skills.

The contents of this paper is as follows. The next section discusses how transaction costs and international organisation of production may affect employment from the theoretical perspective of transaction cost economics. Sections 3 provides information on the set up and the characteristics of the survey amongst personnel managers and on the seven companies of our in depth interviews. Section 4 confronts the results on employment effects of outsourcing from the literature with our findings from the survey and the in depth interviews. Section 5 zooms on the shifts between transformation workers and transaction workers that the ongoing trend of international specialisation of labour brings about. Section 6 investigates the types of work that are of importance in this shift of tasks to be performed in a transaction economy like the Netherlands. More specifically Section 7 considers a classification of competencies needed for performing tasks in the fields of transformation and of transaction. Section 8 translates these findings to their relevance for the labour market in the Netherlands. Section 9 summarizes and concludes.

2. A theoretical perspective on transaction costs and the labour market

This era of globalisation witnesses a trend with increased *division of labour and specialization*, both within national economies and the world as an entity. Specialization means exploitation of economies of scale and using the diversification of skills and availability of resources in the production of goods and services. Production shifts to the place where it is relatively cheapest. Therefore, most developed countries, especially the open economies, with a high amount of trade, observe a decline in employment in agriculture and industry, with employment in trade and services showing an increasing trend. Availability in a country of raw materials and capital, both physical and human capital, functions to determine what is produced and what is traded. These are known as the *comparative advantages* of a country in international trade. Traditional trade theory explains the goods and service trade flows from such comparative advantages. A country with rich natural resources has a competitive advantage in that aspect and will be able to sell its resources, whether processed or not, profitably in world markets. The same applies to a country where labour is relatively cheap, due to low wages, or to be more precise, where the productivity of labour is high relative to wages. In this case exports of labour intensive products and services are relatively profitable.

Yet, these differences in availability of resources between countries - labour, capital and raw materials - only partially explain international trade. When all comparative advantages were fully exploited, world trade flows would be far greater than they actually are (see e.g. Trefler, 1995). The explanatory power of this type of comparative advantages appears limited in a modern economy. In international trade, and especially in those countries where trade and transactions are a driving force in the economy, other aspects play a more important role. Here it is essential to realize that trade is not for free, but brings about different kinds of costs. Indeed, the division of labour and specialization, on the one hand, has the effect that the production of goods and services becomes more efficient. This holds true both for the division of labour and specialization within firms, and between firms and countries. Division of labour and specialization imply that the various activities should be coordinated and organised. All costs of this coordination and organisation can, in a broad sense, be regarded as *transaction costs.*

In this era of globalization it is essential to keep these transaction costs as low as possible. This is what transaction management does: t*ransaction management provides insight into how these*

transaction costs (or coordination costs) can be minimized. In other words, transaction management shows how cultural differences, differences in laws and regulations, in work ethics, in quality control and in government regulation can be dealt with at lowest costs. Through computerization, reduction of transport costs and reduction of formal trade barriers the world seems to have become "flatter" (see Friedman, 2005). Indeed, these “hard” and visible transactions have gradually decreased. That is the engine of the current globalization. In contrast, however, there are "soft" and far less visible transaction costs. They may be the result of cultural and legal differences, limited information and information uncertainty, trust and the lack thereof, red tape, political turmoil etc. Transaction management focuses primarily on reducing these soft transaction costs.

Hard and soft transaction do not only play a role in the usual commercial transactions involving trade and therefore change of ownership of goods or services. In case of hiring personnel transaction costs are also important: think of search costs, information costs, application fees, costs of getting acquainting with a new job, severance costs and all costs of the personnel department, including advertising costs. After all, a contract is in a sense a form of transfer of ownership of an employee to his or her boss. Moreover, marketing costs and information costs can also be regarded as part of transaction costs. Within firms are all kinds of team meetings to discuss coordination and sharing out of work, regulatory and internal compliance costs and so on, can be seen as transaction costs.

The economic theory of transaction costs

The role of transaction costs in economics is well established: three economists have been rewarded the Nobel Prize for Economics for their contribution to the theory of transaction costs, namely Coase, North and finally Williamson in 2009. Coase (1937) formulated the first ideas about the role of transaction costs it more than 70 years ago. He explained that transaction costs is the reason why firms of any size do exist: firm size depends directly on the nature of the transaction. In the case that the (marginal) transaction costs are higher for exchange within the hierarchy than for exchange through the market, it is obvious that parts of the firm are to be split and benefit from lower transaction costs of trade through the market. The firm size then decreases. The opposite - transaction costs are lower in the hierarchy than through the market - provides an argument for an expansion of the firm.

The economic theory of transaction costs has subsequently been implemented primarily by Oliver Williamson, who defines transaction costs as the costs of running the economic system. Williamson (1999) explicitly discusses the link between transaction cost economics and management and organization theory, although not giving it the name of “transaction management”. From the perspective of strategic management of a firm it is the positioning in the supply chain that matters. In that respect, the "make or buy" and location decisions when outsourcing of parts of the chain is considered, play an important part.

A central notion in the work of Douglass North (1990) is that the ongoing interaction between rules and players, or between institutions and organizations, underlies the success or failure of an economy. He emphasizes in this context the importance of institutions. That is why transaction cost economics is linked with the theory of (new) institutional economics. Institutions in the sense of North do not only include formal institutions, such as legal rules and regulations.

Informal institutions are very important as well, or even more so. These include socio-cultural phenomena such as the prevailing values and norms, mutual trust, and the commercial or mercantile skills of a nation. This is where the "soft" transaction costs come into the picture.

Major sources of transaction costs

In transaction cost economics, two main sources of transaction costs can be distinguished which are relevant to entrepreneurs involved in organising production and which result from the relational behaviour of the economic agents engaged in the transaction. These are:

1. Bounded rationality; and
2. Opportunistic behaviour.

Bounded rationality has two reasons: (i) informational complexity and (ii) informational uncertainty. Informational complexity refers to the fact that individuals have limited abilities to process all available information. Hence, an individual is unable to process all relevant aspects of a transaction. Informational uncertainty, by contrast, refers to the fact that it is impossible to perfectly foresee all future states of the world. *Opportunistic behaviour* refers to the 'self-interest seeking behaviour' of individuals (Williamson, 1985). Without opportunistic behaviour it would not be necessary to fully specify complete contracts. Therefore, the transaction costs that arise through bounded rationality do not exist per se, in case individuals do not want to gain advantage over the loss of another individual.

A third major source of transaction costs stems from the characteristics of the good s or services that are object of the transaction. This relates to:

3. Asset specificity

Here, *asset specificity* is defined as the extent to which an investment supporting a transaction has more value in that specific transaction than in any other purpose. Asset specificity relates to goods or services that are bound to certain specifications. When the first transaction has been defined and approved with respect to these specifications, the following transactions can take advantage of the fact that the specifications are known and, thereby, fewer transaction costs need to be made. By contrast, the more goods or services are tailored to the individual requirements of the buyer, the higher the asset specificity. It is obvious that there is a relationship between asset specificity and standardization, as standardization will make the specifications transparent and, therefore, reduce asset specificity. Uniform standards ensure that traders need to spend less time defining the specifications of the goods or services so that they will encounter fewer transaction costs. By contrast, the demands of buyers to suppliers can be so specific that standards have to be developed that can only be used in that particular situation. This enlarges the mutual interest that buyers and suppliers have in maintaining their trade relationships.

Trade in tasks

Now that fragmentation of production and international outsourcing gained momentum, comparative advantages in the Ricardian sense no longer relate to finished products and services, but rather to a *trade in tasks.* From that perspective Grossmann and Rossi-Hansberg (2008) present a model for the determinants of international trade, which makes an explicit distinction between trade in goods (the traditional approach to model international trade) and trade in tasks. In this model, production involves conducting a continuum of 'tasks'. Different economies are now not trading in finished goods, but it is the tasks, or sub-sets of the production process, which

are tradable. Some tasks may require high-skilled labour input, while other tasks require low-skilled labour or even another factor input like capital or different categories of labour.

The special feature of the trade in tasks model is that when certain tasks are moved abroad, this is done in all industries. For example, when low-skill tasks are moved abroad, this is done both in the industry which is intensive in low-skilled labour and in the industry which is intensive in high-skilled labour. Therefore trade in tasks will even occur when there are no differences in relative endowments. The trade in tasks model thus successfully links trade and transaction costs to Trefler's (1995) 'missing trade puzzle' (Baldwin and Robert-Nicaud, 2010).

Grossmann and Rossi-Hansberg (2008) distinguish three effects of the reduction in transaction costs in case of offshoring and of outsourcing of tasks:

1. Productivity effect;
2. Relative-price effect; and
3. Labour-supply effect.

The *productivity effect* occurs through a decline in the costs of tasks being moved abroad. Firms incur lower costs, since more tasks can be performed offshore less expensively, which drives up the demand for domestic factor inputs, thereby increasing the return to domestic factors. The *relative-price effect* occurs through a change in the terms of trade of a country. This effect is likely to influence the return on low-skilled labour adversely. An improvement in the terms of trade, defined by the price of exports in terms of imports, will put downward pressure on low-skilled wages since the exporting, high-skilled industry becomes more profitable and will draw resources from the import-competing sector. Finally the *labour-supply effect* occurs through the release of domestic labour, which is freed by moving labour abroad. This effect is also likely to depress low-skilled wages.

Meanwhile, a decrease in the costs of offshoring affects high-skilled labour and other factor inputs as well. According to the model of Grossmann and Rossi-Hansberg, offshoring low-skilled tasks has no productivity effect for other factor inputs, since it has no direct effect on the wage bill of these other factors. However, the relative-price effect and the labour-supply effect do have such a direct effect. The relative-price effect, causing an increase in the terms of trade, boosts the high-skilled-intensive exporting industry and thereby the return on high-skilled labour. The labour-supply effect drives down the relative prices of low-skilled labour, which is equivalent to an increase in the relative prices of high-skilled labour.

Overall the conclusion from this theory on trade in tasks is that a decrease in the costs of offshoring can affect the returns on low- and high-skilled labour in different ways. When, for low-skilled labour, the positive productivity effect outweighs the negative relative-price and labour-supply effects, low-skilled labour will benefit. Otherwise, the return on low-skilled labour decreases. The return on high-skilled labour will increase in all cases, since both the relative-price effect and the labour-supply effect are positive. Therefore, from the perspective of distribution the important issue is whether the positive effects for low-skilled labour outweigh the adverse effects. This seems to be different for small and large economies. In the first case, domestic low-skilled labour benefits from the increased offshoring, whereas domestic high-skilled labour and other factors are unaffected. In the case of a large economy such as the United States, which may influence world prices, the situation is different. The question here is whether the productivity

effect outweighs the relative-price effect. This depends, for example, on the elasticity of demand of the traded goods, which determines the relative strength of price movements. The conclusion is that it is equally possible for low-skilled labour to benefit than it is to lose out from the reduction in the costs of offshoring. As before, the return on high-skilled labour is only affected by the relative-price effect and thereby benefits from reducing the costs of offshoring. These effects differ little when the model allows for other tasks next to low-skilled tasks to become tradable as well.

Figures 1a and 1b show the transition from trade in finished products and services to a trade in tasks. Trade induced by comparative costs differences implies that a country will specialize in producing goods or services where its comparative cost advantage is largest as compared to its trading partner. Figure 1a illustrates this traditional Ricardian trade theory for two countries, A and B. Country A produces product X and the whole production process with tasks X1, X2 and X3 is executed at home. A similar situation applies for country B with product Y. Here the tasks Y1, Y2 and Y3 are conducted in the home country. In this traditional trade situation comparative advantages in production lead country A to export X to B and country B exports product Y to A. However when the potential for increased fragmentation of production becomes exploited, specialization will take place at a more detailed level, namely at the level of tasks. Now the international division of labour no longer covers the different products but the tasks in production. The higher the degree of standardization and the less the customer contact (so with less asset specificity) the easier it is to separate tasks that can be outsourced. Figure 1b assumes that the organization of the production of both product X and product Y takes place in country A. Apparently this country has a comparative advantage in orchestrating production. All tasks with respect to product Y are outsourced to country B, while for product X only task X3 is conducted at home, for instance because that task requires specific skills which cannot yet be outsourced or because the transaction costs of outsourcing are higher than the reduction of the costs of execution of the task abroad. It is clear that a major change in trade flows between the countries results from this new organization of production. Country A is exporting both products X and Y whereas it is importing tasks. For country B, which has a comparative advantage in the execution of tasks, the opposite is true.

Figure 1a Traditional Ricardian explanation of international trade

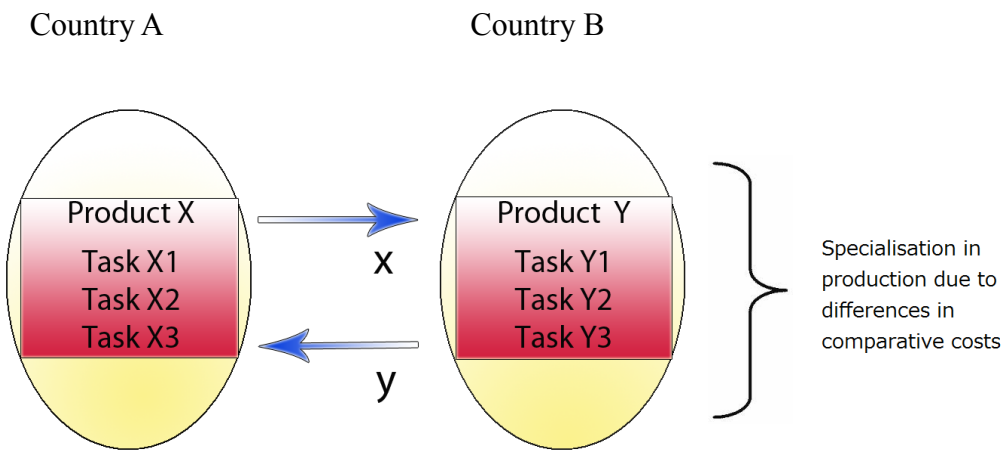
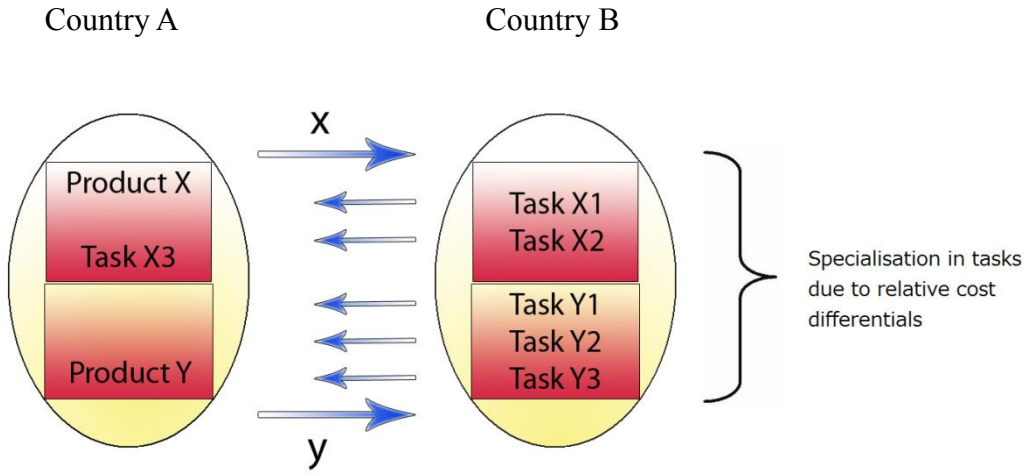


Figure 1b International trade resulting from fragmentation of production and trade in tasks



This trade in tasks can imply that trade within industries, so-called intra-industry trade, increases. But that is not necessary. After all, the tasks that are outsourced can equally well be executed as services that are attributed to other sectors. Think of the production of microchips that are used in products from different sectors, or think of outsourcing the administration and parts of the ICT. Whatever the case, the increased focus on trade in tasks shows that a productivity increase does not solely have to be the consequence of a technological innovation in production, but that a transaction innovation, which reduces transaction costs through better exploiting trade in tasks, can also lead to an increase in productivity.

Opening up the Black Box of the Production Function

The obvious result of these changes in the way international trade depends on comparative advantages is that a new economic theory is needed for a good understanding of the impact of the globalization and fragmentation of production. The traditional theory of economic growth has to be thoroughly revised to really understand what is happening. In their review article on these new theoretical developments, Antràs and Rossi-Hansberg (2009) argue that the traditional theory of the production function sees the way production factors are transformed into a final product as a black box. The new theory seeks to open this black box. Not only the input volume of the production factors and the possibilities for substitution are important for the description of the production process, but also the organization of production should be made endogenous. This creates a theory where elements of the theory of industrial organization are integrated into trade and growth theories. Obviously this new theory on the organization of production is much related to the notion of Coase on the institutional structure of production and the new institutional economics, discussed before, which also aims at opening the black box of production. Transaction costs play a major role in this combination of theories. An important aspect of this theory is that the heterogeneity of production factors should be taken into account. In this context, Grossman and Maggi (2000) describe how the choice of the organization of production may depend on the available qualities of the workforce and, hence, on the warranted characteristics of labour input as a production factor. On the one hand, there can be a production process where the knowledge of brilliant and creative people is needed but, on the other hand, there can also be a production process that is based on established procedures using reliable workers complying with

a hierarchical working environment. Firms may internally exploit these differences in talents for the organization of production, but they can also give rise to an international trade in tasks where one country is gifted with one type of talent and another country with the other type.

A numerical example

A simple numerical example may explain which parameters and information on transaction costs are important in the decision making process on outsourcing and moving some tasks in the supply chain abroad. Suppose a firm has 10 employees that produce 100 units of a product. There is no capital involved. At a wage level of 10, the labour costs are 100. Now the firm decides to outsource production to a country where production costs are half those at home. In this new situation, the 10 employees are transferred from production at home to the orchestration of production in the low-wage country where they are able to achieve an output of 400 units. Production costs are now 200 (400 × 0.5) and the transaction costs of outsourcing 100 (pay for employees in the orchestrating function). Total costs are therefore 300, so that productivity , measured as value added per worker rises by 100% (from 100/10 to 200/10). These profits can be distributed among the employees so that their wages increase to 20, or they can be used for reducing the price of the product (it can also be reinvested or paid to shareholders). This is the productivity effect described by Grossman and Rossi-Hansberg (2008) in their theory on the trade in tasks. In case the rise in productivity is used for higher wages of transaction workers, the productivity effect is matched by a relative price (or wage) effect where differences in wages between transaction and transformation workers increase.

For reasons of simplicity the numerical example assumes that employment at home does not change. The 10 employees who first were production workers are now engaged in organizing and coordinating the production in the low-wage country. It implies that the net labour supply in the home country remains constant, although there is a job destruction of transformation jobs and job creation of transaction jobs. In this example, the outsourcing of production and the resulting increase in production will create new employment abroad. How many new jobs are created in the low-wage country depends on the relative productivity and wages in that country. If productivity in the low-wage country is half of that at home (5), the wages in the low-wage country are assumed to be one-quarter of the wages at home (2.5). This implies that the additional employment in the low-wage country is 80 (400/5). The wage sum amounts to 2.5 × 80 = 200, as assumed. The unit labour costs in the host country are [25/50]*100% = 50 per cent of the home country

This numerical example shows a number of strategic issues that should be taken into account in the entrepreneurial decision to move production abroad:

1. The size of the transaction costs of relocation; here, also long-term effects and risks should be considered.
2. The price elasticity of demand, i.e. the ability to sell more products and the room it gives to reduce the product price as a consequence of the productivity gain; in other words, the issue is the distribution of productivity gains between consumers and producers (including shareholders).
3. The future development of wages in the country where the production has been outsourced; maybe at the time of the decision wages are still low, but for the

foreseeable future a significant increase is expected to take place.

4. The development of wages at home, including the transition costs of training employees for their new jobs as orchestrators and coordinators; these transition costs can be considered a non-recurrent part of transaction costs. In this example these training costs are not taken into account. Furthermore, it is assumed that the wages of employees with an orchestrating function are equal to the wages of those with a production function.

Obviously the strategic decision should also be based on an evaluation of short term costs and benefits versus long term costs and benefits.

3. Data collection

In order to see how entrepreneurs take transaction costs into account in their strategic labour market decisions in the organisation of production, practical experiences at the company level are empirically investigated using a survey among human resources officers and seven company visits with in depth interviews. In this way, a first step is made to gain insight into the impact of an international fragmentation of production for production and employment, and more specifically insight into the competencies required and their relevance to the labour market.

The survey, conducted from 28th March to 15th May 2011, of staff in the manufacturing sector is directed towards employment and competency structure and the degree to which this is related to the labour market. To this end, 856 companies were approached, of which 109 responded. Depending upon the question, the response varied from 46 to 78. Table 1 shows the list of respondents in the survey arranged by their sector classification.

Table 1 Classification of participating firms in the survey by sector

Sector	Total N=46
Metal product industry	39%
Machinery	24%
Electrical and optical equipment	11%
Other (furniture and office furniture industry, bio energy, technical automation and construction materials)	26%

The survey results show that offshore companies in the manufacturing industry have significant transaction and knowledge intensive production - more so than onshore companies. Unfortunately the survey also shows that there are many problems concerning finding personnel with the desired levels of skills.

Looking further into 7 companies

The seven company visits and the resulting interviews made it possible to highlight the consequences of developments with respect to the rising importance of technical knowledge and

transaction-related competencies. The seven visited companies were from the Dutch manufacturing sector, and they are more or less involved in international fragmentation of their production. The manufacturing industry consists of 19 sectors, including the machinery, electro-technical and transport equipment industries. In 2009, the gross value added of the manufacturing industry was nearly €60 billion, which is approximately 10 per cent of the GDP in the Netherlands. The machinery, electro-technical and transport equipment industries generated a value added of around €10 billion, which is 17 per cent of the total value added in industry. The choice of Dutch manufacturing companies, and of the machinery, electro technical, and transport equipment industries in particular, is prompted by the fact that the offshore intensity in these sectors is 4 to 6 times higher than the average at the macro level; the import of parts and components in these sectors in the 1996-2006 period rose by 149 per cent. According to management consulting firm Berenschot (2004) these activities were responsible for around 48% of the total relocated jobs during 2001-2004. This amounts to a third of the total number of layoffs.

In April 2011, 32 companies from the international manufacturing sector were asked for interviews. Finally seven companies were selected for in-depth interview with CEOs or Directing Managers. The companies are:

1. Company X (name kept anonymous at request of company)
2. AWL Techniek B.V. in Harderwijk
3. Damen Shipyards B.V. in Gorinchem
4. Doedijns International B.V. in Waddinxveen
5. SIT Control B.V. in Hoogeveen
6. Terberg Machines B.V. IJsselstein
7. Wärtsilä Netherlands B.V. in Drunen

The results of the conversations are shown in sections 4 to 7. Below follows a short profile of the companies visited.

Damen Shipyards, founded in 1927 is today the largest ship builder in The Netherlands with a turnover of 1.3 billion in 2010. The enterprise has a diverse portfolio of ships: dry cargo vessels, tankers, tugs, hotel and passenger ships, dredgers and research vessels.. In addition to this, the company performs repairs and supplies parts. The company has a global workforce of 5,600 employees of which 2,300 in The Netherlands (2010 figures). The European production is limited to the niche activities of offshore, dredging, coastal preservation, large yachts and small commercial vessels. The first step in internationalising the production process was made in the 1970s. During this period Damen Shipyards started with the purchase of ship hulls in Poland. By the late 1980s shipyards in Poland and Romania were purchased and in the 1990s Chinese shipyards were also purchased, as were shipyards in Singapore in 2000. The activities of the shipyards in Central Europe and Asia were expanded over time from building of ship hulls to the building of complete ships. The motive for internationalisation of production is saving on production costs.

The activities *of Wärtsilä* constitute of ship building (propellers, engine propulsion systems), building of electricity centres of 4-500 megawatt and maintenance and repair. *Wärtsilä* has revenue of 4.6 billion euros in 2010 and has 17,500 employees over 160 locations in 70 countries.

Of those, 1,000 are employed in The Netherlands where revenue in 2009 is 600 million euros. The markets in which *Wärtsilä* operates are characterised by a clear priority: first comes quality, then safety of delivery, and finally costs. The starting principle is that bulk production goes to the bulk market. The production of propellers is therefore relocated from The Netherlands to China. The cost price is not a main-driver for in house offshoring, rather the search for market connection. The production has largely been moved from the Netherlands to abroad.

Doedijns is a supplier of power transmission and measurement and control systems for the energy sector, maritime and dredging industry and engineering. Doedijns booked revenue of 65 million euro's in 2009, and has a global workforce of 275 employees of which 250 are in The Netherlands. Apart from its head office in Waddinxveen, the company has offices in Belgium, England, Dubai and Malaysia for sales and services (maintenance and repair) and for the production of parts and the assembly of products (Dubai and Malaysia).

SIT Controls B.V. is situated in Hoogeveen and is part of the Italian SIT Group which is active in the market for heating products such as free standing heaters, room heaters, patio heaters, pool heaters, ovens, fryers, and bain-maries (water baths). The SIT Group has a total of 1,700 employees situated in 30 different countries. The Hoogeveen office comprises 150 employees and accounts for a revenue of 25 million euro's. Its focus is on the production of electronic systems for the heating industry, with special emphasis on the electronic production of high efficiency heating boilers and heat recovery equipment for the European market. The reason for producing this product in The Netherlands is that large clients regularly require changes to the product. By keeping production in The Netherlands the problem of long delivery and transport times are avoided.

The *Terberg Group* is active in engineering and transport. The company has 600 employees in The Netherlands and 300 employees overseas, measured in full time equivalents (fte's). Total revenue in 2010 was around 450 million euro's. The ratio of value added to revenue amounted to only ten per cent. The enterprise is responsible for activities in the areas of product development, production of prototypes and the engineering to order. The overseas offices of Terberg Group are, under strict orchestration by the management of the head office, responsible for development and design of partial products, production of parts and components, assembly, and supporting services. International production activities occur in Malaysia and Dubai. The office in Malaysia is involved in the assembly and engineering activities. The in-house offshored activities in Malaysia are primarily motivated by cost as well as market strategies. The offices in France, Germany, Belgium, United Kingdom, Ireland and Dubai are primarily concerned with sales and services. Belgium is also responsible for the modification of personnel and company vehicles.

AWL *Techniek* is engaged in the production of welding machines and automatic welding systems to primarily serve suppliers to the automotive industry. There are no deliveries to Original Equipment Manufacturers (OEMs) with the exception of Opel which was due to forced insourcing. The company is located in Harderwijk and had a turnover of 40 million euro's in 2010 and has a workforce of 165 employees in The Netherlands and 18 employees overseas. Value added is 40% of sales value.

Finally, *Company X.* Due to the confidentiality of the data the name of this company remains hidden. This company is concerned with the design, production and maintenance of turbine

machines and systems for aeroplane: starter motors, compressors, air cycle machines and valves. The value added is 50 per cent of total revenue. Only critical parts are made the company itself, the remainder is purchased from independent suppliers or produced in an own location in Central Europe.

The interviews provide an interesting view on how the theory of international fragmentation of production and the transaction management, as described in the previous section, works out in practice in the entrepreneurial decision making process. A major lessons from the conversations is that international fragmenting of production is not synonymous to job destruction at home , but does include the changing of characteristics of the tasks to be conducted in what can be considered as transaction jobs. It is also clear that the possibilities for international fragmentation of production are primarily governed by the skills to reduce soft transaction costs caused by cultural and linguistic distances. These transaction costs can be reduced by standardisation and by good coordination with suppliers. An international division of the production chain ensure for an increase in transaction activities and offers possibilities for expanding company activities in the transformation sphere. International fragmentation of production in this way influences the size as well as the nature of employment. Both the survey and the in depth interview provide useful information on answering the question to what extent international fragmentation of production influences the nature of work activities in the manufacturing industry and what this implies for the required competencies of the labour force.

4 The impact of international fragmentation of production on employment.

The impact of international fragmentation of production for employment is often judged in terms of the *relocation effect*. This effect is often associated with a fear of changes to the supply of labour and a downward pressure on wages as well as a reduction of employment in manufacturing. Berenschot (2004), CBS (2008) and Van Gorp (2010) have, among others, estimated the size of this relocation effect. They conclude that, given the total amount of job creation and job destruction on the Dutch labour market, the relocation effect of international fragmentation of production hardly affects net employment in the Netherlands. There seems to be a lower than average job turnover in the industry, which is a further indication that there are no much job losses due to relocation in industry. Volberda (2007), Ligthart (2008) and Moser (2009) even show that international fragmentation of production leads to production and employment growth, as long as offshoring is not used as a means for downsizing.

Our case studies illustrate that although savings in wage costs is an important motive for international fragmentation of production, this fragmentation is not deployed as a means of downsizing. Indeed, the resultant resources were used to expand activities and solve capacity problems. This finding is confirmed by the responses from our survey with human resources officers in the manufacturing sector. This survey showed that 59 per cent of the companies that had relocated production activities offshore experienced employment growth over a period of 5 years, whereas 57 per cent of companies in the survey that did not offshore production saw their employment grow over that 5 years period. Hence, in both cases, the percentage of companies that experienced growth in employment was around sixty per cent. With employment growth measured as a percentage of total employment in the companies of our survey, companies that did not offshore activities reported a growth of 26.7 per cent, which was stronger than those who did offshore activities and reported a growth of 21.5 per cent. However, due to differences in the size

of the companies, no firm conclusions can be made about the absolute numbers. This offshoring and simultaneously growth of employment does not necessarily reflect the trend of the industry as a whole. A high offshore intensity can indeed been associated with the growth of value added but also with a significant loss of employment in the past decade. Yet there may be indirect effects compensating these direct employment effects. The data cannot distinguish between these direct and indirect effects. For example, an increase in value added could be the effect of improved competitiveness from offshoring, but it could also be the result of market growth. The relationship between offshoring and employment is difficult to determine because the development of employment is influenced by technological development and changes in factor intensities.

The company interviews also show that the offshore intensity is not a good indicator for the degree of international fragmentation of production. Damen Shipyards builts hull shells and assembled ships with the assistance of parts and components that originated, in part, from the Netherlands. This corresponds to the export of goods for intermediate use instead of import. In other words, the foreign building of hulls and assembly activities lower the offshore intensity according to the definition in which the import of goods for intermediate use is related to value added. In reality, there is no decrease in international fragmentation of production. In the case of Wärtsilä, complete production lines were relocated so that use was made of local suppliers or suppliers that had relocated with the production activities. In that case, offshore intensity decreases because the value added of the domestic location primarily results from service tasks. These examples show that a decrease in offshore intensity can often go together with an increase in an international fragmentation of production.

The dominant outcome from our case studies is that offshoring increased value added as well as employment. Only one company did not follow this pattern. The relocation of propeller production to China by Wärtsilä was, for reasons of market strategy, at the cost of the size of transformation tasks. Whether this type of relocation of production can be understood as international fragmentation of production depends on how we define this phenomenon. The narrow definition focuses on the direct production process and subsequent task allocation. The broad definition uses the complete production chain, from creation to after-sales, as its starting point. According to this broader definition, Wärtsilä experienced international fragmentation of production. That is because design and after-sales activities were still (partly) done at home. The offshoring of propeller production not only had consequences for the production workers at Wärtsilä but also for revenue and perhaps for their suppliers' employees as well. The suppliers in the domestic country lose their revenue unless they relocate along with the production tasks. The interviews with Wärtsilä and Damen Shipyards clarified that suppliers were increasingly prepared to relocate with their customers. As a supplier to the maritime industry, Doedijns is such an example. In addition to remain in business, an important motive for a supplier is saving on hard as well as soft transaction costs. If transport costs are lower, communication lines are shorter and reaction times are quicker.

These developments create indirect relocation effects, even though the expanded access to larger markets that results from an expanded commercial network can lead equally to indirect expansion effects. Because in most cases Wärtsilä makes use of local suppliers, indirect relocation effects may outweigh the small amount of indirect expansion effects. The direct replacement effect from the relocation of the propeller production to China amounted to a loss of some 400 jobs.

Approximately 10 per cent of the employees who lost their jobs received another job in another function within the company. However, expansion effects in the development and transaction tasks were for the time being insufficient to compensate for the loss in the transformation sphere. Yet, some compensation for these job losses emerged in the transaction sphere. On November 7, 2011, Wärtsilä opened a distribution centre in Kampen for the global storage and supply of reserve parts. This investment illustrates the shift in the nature of activities of an industrial enterprise in the Netherlands in the direction from direct production to orchestration and management.

Six of the seven companies of our in depth interviews experienced stronger expansion effects both in the transformation and transaction sphere, than the relocation effect in the transformation sphere. The result was net employment growth. However, it should be noted that this finding was specific to cases of customised work and research and development work. Furthermore, there was repair and maintenance work that, due to location specificity, could not be profitably outsourced.

International fragmentation of production has given rise to many new "head-tail companies" (Braaksma, 2009). These are companies whose primary activities focus on design and development (the head) and marketing, sales and after-sales (the tail) but dispose of their production (the body) activities. Figure 1 illustrates this process. In this case, the various company activities are broken up into categories. The interviews showed that international fragmentation of production does not necessarily lead to disposing the body's activities. In the first case, certain in-house activities are relocated offshore (foreign integration). From a geographical perspective, it might seem to be a "head-tail company"; however, when viewing the company as a whole, this is certainly not the case. In the second case, certain activities are performed both onshore and in-house. Examples include critical parts, custom based work and assembly in close proximity to the sales region. Bulk and non-strategic parts come into consideration for offshore outsourcing and contribute to the formation of a "head-tail company". This finding means that products further down the product life cycle come into consideration for offshore outsourcing (Braaksma 2009). An integration of the production and design functions is preferable when the products are complex or require customisation. However, separating production and development into various separate locations can indeed lead to higher coordination costs. Bundling development and production ensures shorter communication lines and delivery times whereby these costs decreased. This situation calls for integration or intensive cooperation with suppliers in one location, and it legitimises the existence of the manufacturing industry in the Netherlands. We already noted that in the companies of our case studies, industrial transformation jobs remained in the Netherlands when it involves design and development, customised work, the production of critical parts and repair and maintenance.

To what degree these transformation jobs remain in the home country is also determined by local environmental factors. In the Netherlands, the availability of employees with the adequate competencies plays an important role. These competencies do not only relate to technical skills but also to the skills of coordinating the various links in the international production process.

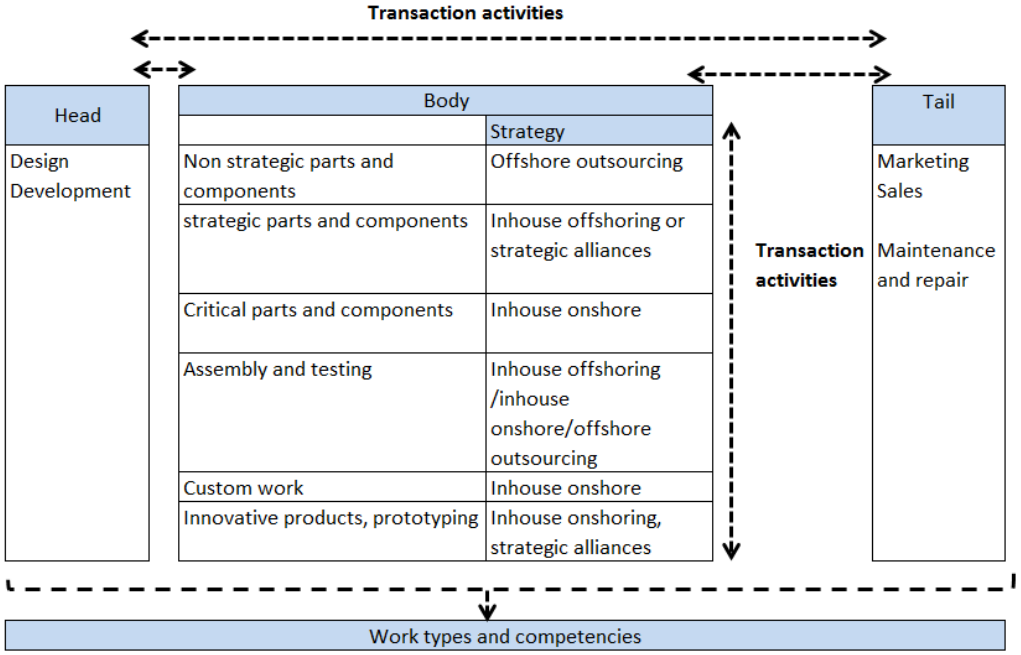


Figure 1 Company organisation

5 Employment of transformation and transaction workers

In labour demand models the degree of international fragmentation of production is related to the difference in wage costs per product unit and the amount of transaction costs. This relationship assumes that onshoring transaction costs are lower than offshoring transaction costs. Our in depth interviews indicate that it is a realistic assumption for the companies of our case study. A change in the productivity-related wage cost ratio or a lowering of transaction costs would imply that further fragmentation of production is warranted. In that case, assuming relocation effects exist, employment in the transformation sphere in the domestic country will decrease. Depending on the price effect, expansion effects offer some compensation in the transformation and transaction sphere for the loss in employment. This compensation or expansion of employment implies that the composition of employment changes.

At the macro level, this trend is already visible given the relative strong growth of production as well as employment in the transaction sectors. The hypothesis is that, due to international fragmentation of production and following a general macroeconomic trend, an increasing number of industrial companies become orchestrators, albeit that from an empirical point of view the boundary between the transformation and transaction sectors becomes somewhat fuzzy. In order to investigate this, the survey amongst personnel officers asked for the percentage of offshore production that was outsourced through foreign direct investments or purchase and the proportion of various categories of employees. It appears that, on average, approximately 35 per cent of employees are involved with transaction tasks when part of their manufacturing production is moved overseas. For companies that exceed 100 employees, this percentage was approximately 40 per cent. That percentage is around a third higher than it is for companies without foreign production activities.

Table 1 shows differences in the relative employment structures of offshore and onshore companies. The data illustrate that, if all companies are considered regardless of size, offshore companies show a higher orchestration and procurement intensity than onshore companies. This trend is particularly true when general management is not included in the data, in which case the differences are substantial. When we make a split up of the companies into larger than 50 employees and larger than 100 employees, the results from the survey show that the larger companies are especially responsible for this difference. This finding is not surprising because the transaction costs that are associated with internationalisation are influenced by scale (for example, see: Berenschot, 2004; CBS, 2008 and Van Gorp, 2010). Similarly, scale also influences the distance of offshoring. The possibilities for international fragmentation of production are therefore, in connection with the geographic, linguistic and cultural distances, related to the scale of a company, which is measured by the total number of employees. The fact that international fragmentation of production requires additional supporting activities is shown by the observation that large companies have a larger proportion of employees who handle secretarial and administrative tasks than onshore companies from the same category do. As the offshore percentage increases, so does the procurement and orchestration intensity.

It is also noticeable from the data that with an offshore percentage of 20 or higher, regardless of company size, the differences with respect to management and procurement intensity decrease. An offshore percentage of 40 or more, on the other hand, increases management and procurement intensity. The results show that the relationship between the offshore percentage and the share of employees with orchestration and procurement tasks is not monotonic. This finding may indicate that expanding foreign production activities leads to a regressive rise in the total number of transaction activities and an increased share of the productivity effect of offshoring to be used in the transformation sphere. From a certain level, international fragmentation of production is associated with a relatively strong growth of transaction activities. This process is supposedly associated with the nature of the relocated tasks. As more tasks are relocated, the complexity of these tasks and the amount of guidance required also increase.

Table.1 Difference of employment structure of onshore and offshore companies

All companies of the sample (n= 43)	Difference compared to onshore companies			
Type of work	Offshore % > 0	Offshore % > 10	Offshore % > 20	Offshore % > 40
Production	4.2	- 3.0	- 4.7	- 8.2
Research and development	-14.1	- 3.7	3.1	12.3
Total transformation	-0.15	- 3.0	- 2.7	-3.0
Procurement and orchestration (incl. general management)	2.6	4.5	3.8	1.3
Procurement and orchestration (excl. general management)	26.8	18.2	15.2	33.3
Marketing	39.1	71.7	87.0	97.8

Support staff, secretarial, administration	-16.2	-14.7	-21.3	-19.9
Total transaction	0.0	5.9	5.0	5.9
Companies ≥ 50 employees (n= 31)	Difference compared to onshore companies			
Type of work	Offshore % > 0	Offshore % > 10	Offshore % > 20	Offshore % > 40
Production	-3.2	-14.5	-10.3	-7.4
Research and development	8.5	43.0	46.5	31.7
Total transformation	-0.7	-2.5	1.5	0.7
Procurement and orchestration (incl. general management)	9.0	13.8	2.1	10.3
Procurement and orchestration (excl. general management)	28.3	15.2	12.1	21.2
Marketing	4.1	18.4	0.0	-3.9
Support staff, secretarial, administration	-8.8	-8.8	-10.4	-14.4
Total transaction	1.6	5.6	-3.1	-1.5
Companies ≥ 100 employees (n= 19)	Difference compared to onshore companies			
Type of work	Offshore % > 0	Offshore % > 10	Offshore % > 20	Offshore % > 40
Production	-11.7	-23.0	-17.0	-22.0
Research and development	-10.7	12.1	7.1	25.0
Total transformation	-11.5	-16.1	-12.2	-13.4
Procurement and orchestration (incl. general management)	21.5	29.5	14.1	27.5
Procurement and orchestration (excl. general management)	90.5	96.2	37.1	119.0
Marketing	72.7	121.2	87.9	30.3
Support staff, secretarial, administration	20.9	24.3	30.4	37.4
Total transaction	26.9	37.7	28.6	31.6

It is noticeable that in companies with more than 50 employees, the share of employees with research and development tasks strongly differs between offshore and onshore companies. The structure of company activities undergoes a clear change when production is internationally fragmentized. The share of employees performing research and development tasks as well as

procurement and orchestration tasks increases in companies with more than 50 employees at the expense of the relative share of production workers and those in secretarial and administrative tasks. The last finding is remarkable because internationalisation is paired with additional administration and registration tasks. This situation contrasts with that of companies with more than 100 employees. International fragmentation of production in this category results in onshore companies in a noticeably smaller percentage of production workers. Companies from this category apparently shift their focus to the areas of development and management.

Although the total number of observations in the survey is limited and further research is necessary, the survey clearly shows a pattern in which offshore companies have a larger share of their activities concentrated in the areas of development, procurement, orchestration and marketing than onshore companies. For companies with more than 100 employees that are involved in offshoring, sheer production tasks seem less important, while the importance of transaction tasks strongly increases. It should be emphasized that the focus in this discussion is on the relative differences between employee categories, so that no conclusions can be made about trends in absolute figures. Despite the decreased importance of production activities, the total number of production workers may increase. So in that respect the survey does not provide clear evidence on the labour demand effect from offshoring tasks.

The results from the survey are supported by the in depth interviews with the 7 companies of our case study. International fragmentation of production by Damen Shipyards led to additional engineering activities. Advantages of scale and larger margins created additional financial funding possibilities. International fragmentation of production caused a huge change in the way Damen Shipyards organizes production. It implies that Damen Shipyards' transformed from being a production company to a company that organizes production and in which three-quarters of its employees perform organizing, orchestration and supporting tasks. Of the 2,300 employees of Damen in the Netherlands, approximately 300 are employed in sheer production (i.e. transformation), 250 are employed in research and development and the remaining 1,750 perform transaction and orchestration tasks. International fragmentation of production has relocated assembly work at Damen Shipyards, and the net amount of production work has remained unchanged, while the total number of jobs with development, design and orchestration tasks and transaction activities has risen sharply. So in this company the fragmentation of production and offshoring brought about considerable employment growth.

This type of shift is also apparent at Wärtsilä. Relocating transformation tasks to China has changed the activities at the home location in the Netherlands to a service business that is characterised by organising production and by service and development tasks. Customised orders, maintenance and repair work at Wärtsilä ensure that 45 per cent of employees are still involved in sheer production activities. Further, 12.5 per cent of employees are involved in research, design and development, and 42.5 per cent are involved in transaction activities (quality control, management, procurement, administration, sales and planning).

At Doedijns, the purchase of parts overseas and the opening of offshore production locations also implied that its focus within its Dutch locations has shifted to the development and organisation of production. Employment in design and development has in recent years grown by 25 to 30 per cent. Former production workers are now involved in development, which required new investment in employee education. To give an example: machine technicians have been re-

educated to review and evaluate technical drawings. The larger role of offshoring is reflected in total job growth, not in sheer production, but rather in management, design and development, coordination, planning, procurement, staff (company lawyers) and quality controllers. The company views knowledge as a core competency and seeks to expand the knowledge-base of its employees in accordance with an increased focus on quality control, testing, procurement, development and design. Because production tasks become less important in the Netherlands, Doedijns expects that the company will shift to be more involved in development and organisation of production. The importance of organising production tasks is again evident: around two-fifths of all employees are involved in transaction and orchestration tasks. A quarter of all employees are involved in sheer production, and a third of all employees are involved in research and development.

The Terberg Group shows a similar trend: offshoring has led to expanded activity and therefore to the creation of jobs, particularly in connection with engineering and organisation tasks. At AWL, approximately 60 per cent of employees work in sheer production and approximately 15 per cent work in research and design. This division of labour means that a quarter of all employees perform transaction and management tasks in the roles of procurers, factory planners, floor managers and project leaders. Given the structure of employment at SIT Controls it seems that this company is primarily a production company: of all personnel, around 80 per cent are involved in sheer production and assembly production, 10 per cent are involved in development and design and the remaining 10 per cent are fulfilling transaction and orchestration tasks. It should be noted in this case that the head office is located in Italy and that production personnel also invests time in planning, supervising, and reporting. This activity involves eight employees who spend part of their time in planning and management.

From the survey data presented in this section and the discussion of the case studies, it can be concluded that international fragmentation of production results in a shifting of employment towards service tasks both in the transformation and the transaction spheres. In the transformation sphere, this is expressed through the larger role of research activities in offshore companies but also through assembly, maintenance and repairs. As for sheer production tasks in the transformation sphere, offshore companies are particularly involved in customised work and in the production of critical components.

In order to connect the various links in the supply chain the offshoring companies encounter a number of coordination problems which enhance transaction costs and cause an increase in the number of personnel engaged in these coordination activities. Although standardisation may help to reduce these problems, it seems that geographical, linguistic, cultural and technological differences warrant that offshore companies have a larger percentage of transaction workers than companies that are not engaged in offshoring.

This shift in employment means that there is not only a change in the nature of activities but also in the level of competencies needed to fulfil these tasks. These changes occur not only because relocating production tasks turn offshoring companies into “head-tail companies”, but also because this process is associated with additional transaction activities that are required in an international environment. The important question is, which types of work and competencies will increase in importance and to what extent will the labour market be able to cater to these changes?

6 Shifts in work types with international production

It is evident from the survey and company interviews that companies invest part of gains from the productivity effect of outsourcing into the development of new products and the financing of additional transaction work. The composition of the value added (see Figure 2) thereby shifts to higher value service activities in the transformation as well as the transaction spheres. Technical skills and knowledge remain as important as for companies that focus on sheer production at home. Custom production and the production of critical parts remain of importance for the domestic location. The shift towards service activities in the transaction and transformation spheres and higher value production tasks also means a shifting in the importance of specific work types (tasks comprising a job). The consequence is that the competencies that are required by employees in the manufacturing industry will change.

The changes in types of work and required competencies due to shifting company activities can be drawn from the CBS 2010 Standard Classification of Occupations. It describes 147 different occupations. Table 2 shows the relevant work types for the manufacturing industry and divides this work into transformation activities (production, research and development and after-sales) and transaction activities (orchestration, procurement and support).

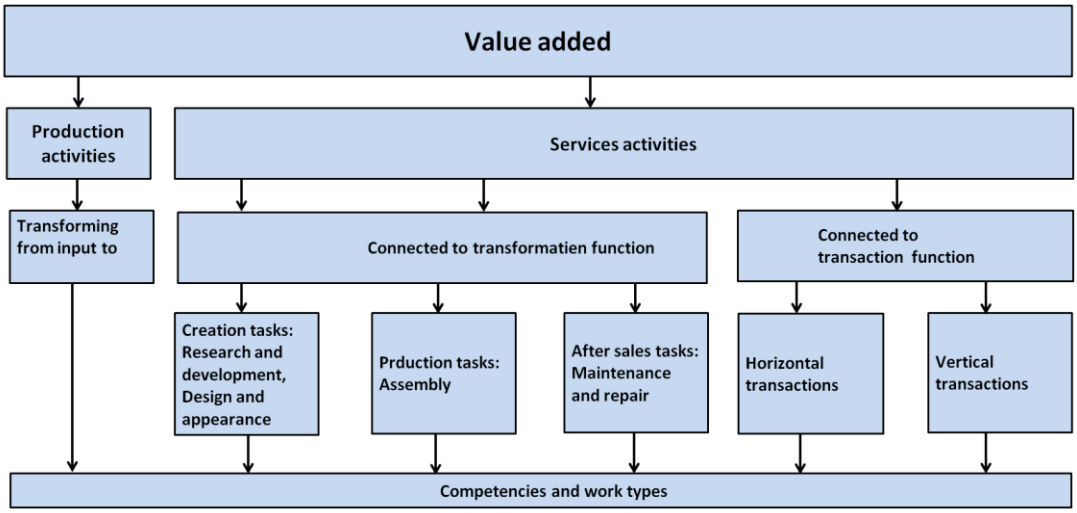


Figure 2 Components of value added at enterprise level

A job consists of a combination of work types that may originate from various categories. A transformation job or a transaction job can therefore not be strictly separated in terms of work type from the transformation or transaction spheres. Transformation jobs may contain types of work that belong to the transaction sphere. For example, the job of a head mechanic of electrical appliances and installations exists according to the CBS within three work types: building, repairing of electrical appliances and installation (work type 655); mechanical installation and machine maintenance and repairs and assembly (work type 682) and leading operational staff without budget responsibility (work type 014). Work type 014 is an orchestration task, whereas the two other work types 655 and 682 suggest that this job belongs to the transformation sphere.

Transaction jobs lack this overlap. In the national vacancy database as of 13th October, 2011, the tasks of the job of a strategic or tactical purchaser are all transaction tasks: assisting with procurement policy; managing strategic supplier relationships; designing the organisation and process of procurement; providing leadership to purchasing projects; analysing internal requirements and communicating to suppliers; selecting suppliers; finalising (complex) contracts; managing the purchasing budget; ordering and reviewing quotations and supplier presentations; settling product and invoice discrepancies and establishing supplier contracts. These types of tasks can be classified into various relevant types of work shown in Table 2 and separated into categories of transaction activity management, procurement and support: 011, 012, 013, 014, 015, 021, 022, 033, 123, 124, 131 and 521, respectively.

The results from the survey discussed before, suggest that companies that form part of an international production network, either through foreign direct investment or through procurement, are much involved in creation tasks in the transformation sphere. If we relate these tasks to work types, then design, contracting, product development, technical drawing/measuring (work types 031, 032) and testing (work type 124) have become more important due to international fragmentation of production. The in depth interviews with the companies indicate similar results: the relocation of production tasks does not mean that development tasks are relocated as well, but rather that they are expanded.

The smaller number of production workers in offshore companies indicates that through international fragmentation of production, the following work types have decreased in importance: 610, 611, 612, 613, 615, 621, 622, 661 and 662. The company interviews clearly showed that this decrease does not mean that these work types will disappear from the Netherlands. More likely, it means that custom production and assembly and the production of critical parts are less suitable for offshoring due to both a longer reaction time and the fact the volumes are too small to warrant outsourcing in the first place. Therefore, the degree of asset specificity influences which types of work are warranted. Depending on their scale, simple assembly tasks that are characterised by a high level of standardisation are suited to internationalisation. The costs for the coordination of such tasks are lower because these types of task can be easily communicated.

In other words, it is not only the type of work that is a determining factor for possible offshoring but the type of work in combination with the characteristics of the product in question. Tasks that demand a high level of precision or are warranted in the production of single orders are, as evidenced from the company interviews, less suitable for offshoring. This is due to differences in standards of quality and the high costs for quality control. A work type such as fine detailed mechanical work (work type 614) would therefore be presumably less at risk in case of international fragmentation of production.

The ease with which work types can be relocated abroad also depends on whether these work types are bound to location. Repair and maintenance are industrial services that are location bound and are therefore less likely to be affected by international fragmentation of production. As a result, work types 681, 683, 655 and 624 are less prone to international fragmentation of production.

Table 2 Work types in the transformation and transaction sphere

Transformation activities
Production (Production of parts and components, maintenance, repair, assembly)
610 melting, melding, casting 611 plastic shaping 612 machining 613 metalworking round 614 fine mechanical work bench 615 welding, cutting, soldering 616 sheet metal work 621 mounting structures 622 assembling: production line 661 production monitoring 662 (production) machines set conversion, control
Research and development (Testing, product development, research of components and production techniques, drawing, constructing material plans)
031 design, construction, product development 032 technical drawing / measuring 124 checking, testing, sorting
After sales (installation, maintenance, repair)
624 install, repair: electronics 655 building, repairing electrical equipment and installations (not building installations) 681 plant and machinery on site build (assembly) 682 plants and machinery maintenance and repair (assembly): mechanical 683 (motor) vehicle maintenance, repair
Transaction activities
Management
011 managing executives and organizational strategic and tactical control 012 managing executives and organizational strategic and tactical control 013 managing executives and organization (department) mainly tactical and operational lead to fiscal responsibility 014 directing performers (operational) without fiscal responsibility 015 strategic control without leadership 022 work prepare, coordinate
Procurement
033 calculation (cost calculation) 123 inspection 124 checking, testing, sorting 521 purchase
Support
021 preparing policy 312 ICT applications development 112 legal mediation, representing parties 313 managing ICT 114 legal advice, legal regulations make 411 office management, secretarial work 131 recommend: organizational 412 data types, text processing 133 recommend: technical, technological 451 staff work, job analysis carried 211 translating 551 warehouse into operations 212 interpreters 553 transporting, loading and unloading

311 advising information and communication
851 teaching, teaching

Because, to an increasing degree, the remnant transformation tasks in offshore companies are related to development, customised work and the production of critical parts, it is reasonable to assume that the average skill requirements for transformation tasks increase. In addition, the importance of technical knowledge and research and design skills would increase along with the increased degree of offshoring.

The survey also shows that offshore companies have a larger share of transaction workers than onshore companies. The most obvious illustration of it is the larger role of procurement whereby procurement, formulating, editing and calculating (work types 521, 223 and 033) play a larger role in offshore companies. More procurement implies that the delivered parts and components of assembled products require testing and checking so that work types 123 and 124 have increased in importance. Procurement activities require further staff support and invoicing and stock management (work types 123, 124, 114, 133, 313 and 431) and in turn create their own supporting work types such as the development and management of IT applications, secretarial work, data entry, word processing, advising on technical issues, technology, ICT and legal, judicial arrangements, written and verbal translation, legal mediation, business representation, warehouse operations, transport activities, loading and unloading (work types 312, 313, 411, 412, 133, 211, 212, 112, 114, 551 and 553).

Given that the international fragmentation of production is accompanied with a higher complexity of orchestration and planning structures, then work types such as preparation and coordination (work type 022) will increase in importance, as will the leadership of managers and executives and the strategic and tactical management of the organisation (work types 011 to and including 015). These work types also require support by IT resources and legal, administrative and secretarial support, as well as support by personnel officers (work types 312, 313, 411, 412, 131, 021, 114, 311 and 451).

Because partnerships with offshore companies or the establishment of overseas production facilities require a transfer of knowledge and instruction, teaching and lecturing (work type 851) or educating and communicating (work types 135 and 136) become more relevant. For example, Wärtsilä invests in knowledge transfers to educate and assist suppliers, and AWL Techniek offers training programs for local managers at overseas production locations. AWL Techniek also organises personnel exchanges to reduce technological, cultural and linguistic differences.

7 Which competencies are required for the orchestration of international production?

A fulfillment of a job combines various work types and can only be performed when employees possess the required competencies. A competency can be described as “the acquired ability to perform a task adequately” (Roe, 2002). Competencies can be separated into four categories (Erpenbeck and Scharnhorst, 2006): (i) professional and methodical competencies, (ii) social communicative competencies, (iii) personal competencies and (iv) integrative competencies.

Figure 3 shows this classification.

Integrative competency refers to the fact that a function is comprised of various tasks whereby only the combination of competencies can result in an adequate performance of the function.

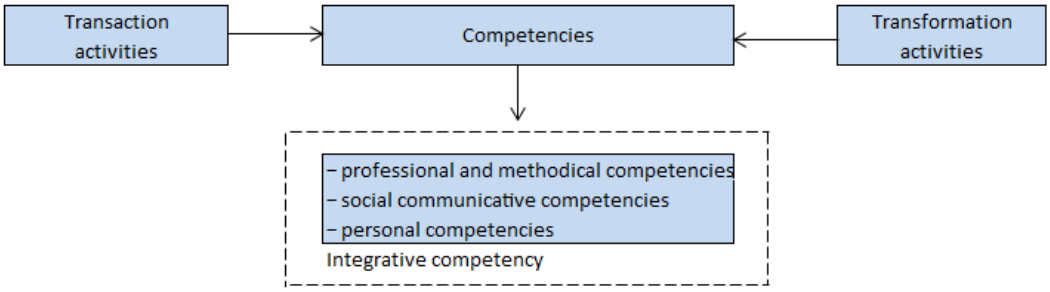


Figure 3 Classifying competencies

Personal competencies are more or less innate competencies that can be at the most be strengthened or weakened. These are competencies such as friendliness, patience, stress resistance or flexibility. Such competencies are in general characterised by one's nature. That is, their meaning becomes clear in combination with a concrete performance of a task. For example, stress resistance can be related to the time pressure of production but also to a psychological pressure during the process of decision-making. Due to the general character of these competency categories, the personal and integrative competencies are not considered here, and only the first two, the professional and methodical competencies and social communicative competencies, are taken into consideration.

Social communicative, professional and methodical competencies can be learned through schooling and experience. This learning involves knowledge, skills and professional attitudes. For example, social communication skills can be learned through experience but also by acquiring knowledge of presentation techniques and by learning other people's backgrounds. It contributes to the ability to join fragmented production phases, because in the process of adapting to a production and solving problems in an international environment, many differences in language and culture must be overcome. Multilingualism and intercultural knowledge and skills in these areas can be viewed as pre-requisite competencies for skills such as negotiating, coordinating and problem solving. Negotiating, coordinating and problem solving skills can be classified under professional and methodical competencies. These competencies are directly related to executing the work types that are required in offshoring professions. In this way, negotiating, coordinating and problem solving skills are important for companies that operate in an international environment in which purchasing and orchestration activities take place. Just as a metal worker must be able to operate a particular machinery, so must a researcher in the manufacturing industry possess technical knowledge and research skills to perform his or her functions.

The above-mentioned competencies can further be split up in various sub-competencies. The competency of research skills assumes knowledge of CAD/CAM software, design techniques, production techniques, knowledge of materials, strength of materials, mechanics, patent procedures, analytical capabilities, inventiveness and accuracy as well as a range of social

communicative skills. To work with machines assumes the ability to read technical drawings and the possession of computer skills and accuracy. Yet, it would go beyond the scope of this paper to conduct a full analysis at the level of these sub-competencies.

Not only can professional and methodical competencies be learned, they are also further developed by doing in practical situations. Particular competencies remain generally applicable, such as statistical knowledge and the ability to think structurally. Other occupational and methodical competencies are the result of specialisation in a particular environment, and they are less applicable outside of the direct environment, thereby increasing ties between the employee and the company or sector. These competencies are more firm specific. Although social communicative skills are generally less firm specific or sector specific, these skills also develop in specific specialized environments. A company with production locations in India might develop specific communication skills for the Indian region that might be less applicable in a company in a different geographical area of the international production network.

Table 3 Competency classification

Competency	Function	
	Transformation	Transaction
(International) financial knowledge		x
Intercultural knowledge and skill		x
Negotiating skills		x
Problem solving skills		x
Coordinating skills		x
Advising skills		x
Multilingualism		x
Language skills (Dutch)		x
Technical knowledge	x	
Research skills	x	
Machine operation skills	x	

Table 3 shows the above-mentioned competencies categorised into two functional areas: transformation and transaction. Eight competencies are considered to be transaction-related. These competencies have relevance to financial and cultural knowledge and skills in communicative areas. They fulfil a central role in connecting the links of an internationally diversified supply chain. Three competencies are connected to the transformation function. Operating machines represents sheer production, and research skills represent creation tasks. Technical knowledge is needed both for sheer production tasks as well as for creation tasks.

Table 4 Competencies needed for various transformation and transaction tasks

Competency	Transformation sphere			Transaction sphere		
	Production	O&O	After sales	Management	Procurement	Support
(International)				x	x	x

financial knowledge						
Intercultural knowledge and skill				x	x	
Negotiating skils					x	
Problem solving skills		x		x	x	
Coordinating skills				x	x	
Advisory skills		x		x		
Multilingualism		x		x	x	x
Language skills (Dutch)	x	x	x	x	x	x
Technical knowledge	x	x	x	x	x	
Research skills		x				
Operating machinery	x		x			

The fact that competencies are divided into transformation-related and transaction-related categories does not imply that transaction-related competencies are less important, or even of no importance, for transformation tasks. Transaction activities play a role in transformation occupations. For example, linguistic competencies are needed for functioning within teams, both internally and externally. Linguistic competency is important because international fragmentation of production requires the efforts of multilingual personnel due to the collaboration with overseas suppliers and colleagues. Research activities also often require international collaboration or collaboration with colleagues from other backgrounds. Not only are transaction-related competencies important for performing transformation tasks, the reverse is also true: orchestration and procurement activities in the manufacturing industry require technical knowledge. Meeting the internal demand of components and parts in the suppliers market, selecting suppliers and establishing (complex) contracts requires not only transaction-related competencies but also technical knowledge. It is a prerequisite to adequately perform such orchestration and procurement activities. Table 4 shows transaction and transformation-related competencies needed for various activities in the transformation and transaction spheres.

As the results from the survey in Table 1 show, transaction activities assume a more important role in companies that scatter their production internationally compared to those that do not. In companies with a heavier focus on procurement and orchestration, transaction-related competencies will play a relatively larger role. Furthermore, the interviews with the companies indicate that companies that have organised their production internationally have used the freed-up capacity and financial resources for product development, thus further increasing the need for, and the importance of, technical knowledge. The expectation is that technical knowledge is also necessary for an adequate execution of orchestration and procurement tasks in an industrial enterprise. On that basis, it is assumed that the need for a cluster of transaction-related competencies in combination with technical knowledge and research skills positively correlates

to the degree of international fragmentation of production.

To test this assumption, the human resources officers of the survey were asked to determine the importance of each competency of those collected in Table 3. The competency variables are in various combinations regressed with the degree of offshoring. The Cronbach's alpha of about 0.7 or higher indicates that the mutual correlation is sufficient to serve as a compiled variable. For two clusters compiled in this way, Table 5 shows a positive t-value, significant at the 0.05 probability level, indicating that offshore intensity significantly contributes to the importance of various competency groups. For example, competency cluster I, in which transformation and transaction-related competencies are included, shows significant positive correlations with the offshore intensity that is consistent with the survey results. Table 5 shows that an increase in offshore intensity explains an 11 per cent increase in the importance of transformation and transaction competencies. This correlation is stronger if machine operation is omitted in cluster II. The offshore intensity is then responsible for a 13.2 per cent increase in the importance of the given transaction competencies combined with technical knowledge and research skills.

Table .5 Connection between offshore intensity and competency structure

Dependent variable / Independent variable	Competency cluster I	Competency cluster II
Share of offshore production of total production value	R2** 0.11 t-value 2.276 Cronbach 0.698	R2** 0.13 t-value 2.495 Cronbach 0.730

** significance level 5%, n=47
Competency cluster I: (International) financial knowledge, intercultural knowledge and skill, language skills, negotiation skills, problem solving, advising, research and coordination skills, multilingualism, machine operation, technical knowledge
Competency cluster II: as above, excluding machine operation

These regressions using the data from the survey show that international fragmentation of production increases the importance of transaction-related competencies in combination with technical knowledge and research skills. This finding is consistent with the results that are shown in Table 1 and indicates that, as the value chain becomes more internationalised, a larger share of personnel are concerned with transaction activities and product development. Transaction activities and product development are activities that require technical knowledge. This combination of competencies also emerges as important when in the in depth interview when asked about the extent to which the transaction and transformation competencies increased or decreased. Table 6 summarizes the answers to these questions. In general terms, transaction-related competencies, technical knowledge and research skills showed an increased importance in the case studies. The table shows that multilingualism and intercultural knowledge and skills had become more important in all companies of our case studies. International financial knowledge, coordinating skills and problem solving skills had increased in importance for six of the seven companies, negotiating skills increased for five of the seven companies and advisory skills were deemed more important for four of the seven companies.

Remarkably not one company observed that Dutch language skills had increased in importance. The suggestion that international fragmentation of production leads to more internal orchestration and coordination and therefore requires higher language skills is not confirmed in the interviews.

Table 6 Importance of transformation, management and transaction related competencies

Competency	Company						
Transaction tasks	Damen Shipyards	Wärtsilä	AWL Techniek	Terberg Group	Company X	Doedijns	SIT Controls
(International) financial knowledge	+	+	o	+	+	+	+
Intercultural knowledge and skills	+	+	+	+	+	+	+
Negotiating skills	+	+	o	+	o	+	+
Problem solving skills	+	+	+	o	+	+	+
Coordinating skills	+	o	+	+	+	+	+
Advisory skills	o	+	+	+	o	+	o
Multilingualism	+	+	+	+	+	+	+
Language skills (Dutch - verbal and written skills)	o	o	o	o	o	o	o
Transformation tasks							
Technical knowledge	+	o	+	+	+	+	+
Research skills	+	o	+	+	o	+	+
Machine operating skills	-	-	o	o	+	o	o

increase (+), decrease (-) or no change (o)

It is also striking that the competencies required for transformation tasks with respect to technical knowledge and research skills have increased equally in importance. There are two reasons for that parallel increase. First, the increase follows logically form the fact that the transformation sphere shifts its focus to creation and customised work. Even for a company such as SIT Controls, which considers itself to be a technology follower, the importance of technical knowledge and research skills increased. This increase in the importance of technical knowledge and research skills addresses what the company sees as its core competencies: an internal process-orientated organisation of production through design and assembly. By working with fewer components, improving installation diagrams or adjusting design, a product can be produced more simply and cheaply. Second, the interviews show that technical knowledge and research skills have also increased in importance for orchestration and transaction tasks. To enable the connection of various production links requires that project leaders possess the required technical knowledge. For strategic and tactical procurement technical knowledge is also important for selecting suppliers in the procurement process and for checking the quality of deliveries.

One notable exception is the operation of machinery. From the interviews we learned that there are two reasons why this competency was considered less important when the production becomes more fragmented. First, this competency is less needed when offshoring transformation tasks, or remains at most the same in case of customised projects, maintenance and repairs. The second reason is that machinery itself is becoming more complex, but the navigation, due to informative dashboards, becomes simpler, according to AWL Techniek.

So the next question, to be answered in the following section, is to what extent will the labour market and vocational training institutions have to respond to the increased importance of the combined skills of technical knowledge and transaction skills.

8 Relevance to the labour market in the Netherlands

The data collected by us at the macro level show that in The Netherlands more than half of all jobs in the commercial sector are transaction jobs. As The Netherlands still moves more and more to be a transaction economy, and given the global shift in the international distribution of labour, this ratio of transaction jobs to transformation jobs will only increase. The case studies and survey also indicate that a large portion of activities in the manufacturing sector is comprised of transaction activities. For companies that relocate production activities offshore, more than four-fifths of the total number of employees are involved in transaction activities. Although we do not avail of data regarding the share of transaction workers in the transformation sectors in general, the survey does show that all the companies in the survey had an average of one-third of their staff employed in transaction jobs. That value excludes the transaction and orchestration tasks of employees with sheer production tasks or tasks in the area of research and development. Taking the above-mentioned percentages as a starting point, the total share of transaction workers in all the commercial sectors in the Netherlands is 62 per cent; in the commercial sector, it is 70 per cent. For the growth potential of the Dutch economy, this finding indicates how important it is to enhance the skills in the labour market for transaction workers. The strong growth of transaction sectors and the larger role of transaction labour in the transformation sectors means that the work types that are involved in organising production (in combination with technical knowledge) become more important.

Data on vacancies in the Netherlands show that the ratio of hard-to-fill vacancies and the average number of vacancies per thousand jobs is two to three times as high in the transaction sectors as in industry. It indicates that the transition from a transformation economy to a transaction economy goes along with high recognition lags at the labour market. These sustained discrepancies between labour supply and labour demand at the level of occupations and skills may have various underlying causes. It could be due to the inadequate skills of unemployed workers and new entrants to the labour market, or it could also be due to a limited mobility of labour between sectors. There seems little labour mobility between sectors implying that that the growth of employment in transaction sectors had become especially possible through the entrance of new employees and not from a net inflow of workers from other sectors.

A continuation of the focus of companies on organisational production and the development of products rather than on the act of production itself, will lead to a qualitative change in labour demand. A labour market that does not comply with this trend forms an impediment for the

growth potential of an important part of the Dutch economy. Initial and secondary schooling (re-training or professional development) are therefore key to increasing the growth potential of the Dutch economy.

For that reason our survey with human resources officers asked the question whether the labour market is inadequate. Table 7 clearly shows that, where transaction-related competencies are concerned, the labour market is woefully inadequate. Intercultural knowledge and skills were determined to be the most important competencies. However, at least two-thirds of the respondents to our survey were of the opinion that the labour market is inadequate on that issue. An almost equal percentage experiences bottlenecks in the labour market with regard to technical knowledge. The least problematic area is multilingualism, even though a mere two-fifths of total companies with offshore production considers this area to be an issue. Companies with offshore production tasks use more hours of labour for management and procurement activities. Competencies such as negotiation, coordinating abilities and problem solving skills are thereby most important. All in all Table 7 shows that a large percentage of the companies experience problems in attracting suitable personnel.

Table 7 Availability of competencies in the labour market reported as average to poor (as % of total companies with offshore activities, n= 29).

Competency	Percentage of companies
International financial knowledge	41.7
Multilingualism	38.4
Negotiating skills	42.3
Problem solving skills	44.4
Coordinating skills	57.7
Intercultural knowledge and skills	66.7
Operating machinery	50.0
Technical knowledge	64.3

It is noticeable that especially companies with overseas production experience problems in finding workers with technical knowledge. Even finding employees able to operate machinery seems to present problems. Both shortages indicate that the transformation function in Dutch manufacturing trade has not vanished due to an international fragmentation of production tasks. As indicated earlier, in the manufacturing trade this is dependent on whether employees with technical knowledge not only conduct transformation functions but also fulfil management and procurement tasks.

9 Conclusion and summary

International fragmentation of production has consequences for the manner in which companies and people work together. This paper focuses on the industrial sector in the Netherlands. It investigates the consequences for the labour market, for mismatches of skills in the labour market, and consequently for the need for education. The perspective is that, as a trade and

industry oriented country, the Netherlands is profiting from international fragmentation of production.

The survey amongst personnel resource officers and the in depth interviews with seven industrial companies in this paper show that several mismatches are encountered with respect to skills and competencies. Intercultural knowledge and skills and technical knowledge are the two most important areas of mismatch. These two competencies are most important when production tasks become fragmented internationally. Companies, that outsource part of their production, usually invest more time in orchestration and procurement. Then not only intercultural knowledge and skills but also technical skills become important. The importance of intercultural knowledge and skills has already been evident in the past. Given that in the Dutch Golden Age, Holland was the only trading country that was able to enter the Japanese market (De Beer, 2003), it seems that breaking through language and cultural barriers increases trade possibilities. According to Shadid (2000), intercultural competencies has three aspects: motivation, knowledge and skills. The motivation for the Dutch to immerse themselves in Japanese culture was obvious, given the economic possibilities. Knowledge of language and customs opened possibilities for trade contacts, but it also required skill to empathise with people from other cultures without forming judgments or stereotypes.

The case studies and the survey also indicate that internationally producing companies in the manufacturing industry have a relatively large focus on creation, transaction and orchestration activities. For these companies, a combination of technical knowledge and international transactional skills is a prerequisite.. Creation, transaction and orchestration activities require different demands on education than in an economy which focuses at industrial production at home.

The case studies and the survey provide a first view on the employment structure in industrial companies that through foreign direct investment or procurement have made the step toward relocating production activities offshore. In that sense this paper provides an important supplement to the existing literature regarding the relationship between international fragmentation of production and its consequences for employment. Through examining the impact on employment on the shop floor, some direct insight is obtained into the relationship between international fragmentation of production and company activities. In addition, the manner in which transaction management and transaction activities can create value has been clarified. There are strong indicators that a relatively large portion of value added of these companies lies in their ability to connect links in the production chain at low transaction costs. The survey showed that offshore companies (particularly when compared to onshore companies that are larger than 50 or 100 employees) have a relatively large share of their workforce employed in transaction and orchestration jobs.

The above findings make us conclude that in the Netherlands the transition towards a transaction economy in which the role of transaction activities in value creation gain importance, is underestimated when only sectoral developments, as reported in the National Accounts, are looked at. Our study shows that the Dutch manufacturing industry, which is much characterised by international fragmentation of production, highly values the efficient performance of these transaction tasks for competitive advantage. However, the importance of technological knowledge in this transaction economy is also stressed, not only regarding the transformation

function with its shift in the focus of creation tasks but also regarding procurement and orchestration activities. In fact, because procurement and orchestration activities are more and more performed in international contexts, the combination of technical knowledge and transaction skills is increasingly deemed important. This situation calls for technical courses with more attention for the types of work and competencies that are connected to transaction activities. Intercultural and language aspects are also essential here. The seven Dutch manufacturers that were interviewed often remarked that the cost side of international fragmentation of production is especially determined by language and cultural differences that lead to differences in the interpretation of agreements and consequently to coordination problems at a cross-process level. Standardisation can minimise these problems, but the gains from standardisation are limited when clients require products of a higher specificity. The consequence is that separate production tasks become more complex, that communication between manufacturers and suppliers intensify and that the demands on intercultural and linguistic knowledge and skills become higher.

Although the employees in offshore companies with procurement and orchestration tasks form a larger share of total employment than in onshore companies, the results of the survey indicate that offshore companies also have relatively more employees with research and development tasks. Although there are relatively less workers with sheer production tasks, the need for customised work, maintenance, service and the production of critical parts remains important. So does the skill for conducting sheer production jobs.

All in all the survey and cases of this paper show that the labour market in The Netherlands is characterised by large mismatches with regard to transaction-related competencies and technical knowledge. A major example is the competency of intercultural knowledge and skills. Two out the five companies in our case studies also mentioned the poor availability of multilingualism. For companies in the manufacturing industry that are part of an international production network, these problems could restrict potential growth. Indeed, breaking language and cultural barriers increases the possibilities for international trade and the further international fragmentation of production. Another major focus of education should be that transaction-related skills and technical knowledge are increasingly applied integratively in various professional situations. Finally, the case studies and the survey clearly indicate that international fragmentation of production has favourable effects on productivity as well as on employment. The companies of our in depth interviews indicated that production was offshored on the grounds of cost and market strategy, but they also experienced a growth of production, value added and employment in the company.

Literature

Antràs, P. and E. Rossi-Hansberg (2009), Organizations and trade', *Annual Review of Economics*, 1 (1), 43–64.

Baldwin, R., (2006). Globalisation: the great unbundling(s), *Prime Minister's Office Economic Council of Finland*, 20 September 2006.

Baldwin, R. and F. Robert-Nicoud (2010), Trade-in-goods and trade-in-tasks: An Integrating Framework, *CEPR Discussion Papers 7775*.

Beer, P de (2003). Laat een Arabier niet de onderkant van uw schoenen zien! (Do not let an Arab see the bottom of your shoes!), *ESB Dossier 'Handel en transactiekosten'* ('Trade and transaction costs), 4 september 2003.

Berenschot Research (2005), Aard, omvang en effecten van verplaatsen bedrijfsactiviteiten naar het buitenland. (The nature, size and effects of relocating business abroad), *Research firm Berenschot*, Utrecht, 12 november 2004.

Berghuis, E. and F.A.G. den Butter (2013), Managing transaction costs in international production; evidence on entrepreneurship from case studies in the Netherlands, *mimeo VU University Amsterdam*, June 2013.

Braaksma, R.M. (2009). Kopstaartbedrijven (Head-tail companies), *EIM,* Zoetermeer, april 2009

Butter, F.A.G. den (2012a), Managing Transaction Costs in the Era of Globalization, *Edward Elgar Publishing*, Cheltenham.

CBS (2008). International Sourcing. Moving Business Functions Abroad . June 2008

Coase, R.H. (1937), 'The nature of the firm', *Economica*, **4** (16), 386–405.

Eigner, M., B. Schleidt., H. Schulze., C. Clases and T. Ryser. (2007). Succes factors for Virtual and Intercultural Project Work*, ProSTEP iViP Science Days* 2007, 162-168.

Erpenbeck, J. , A. Scharnhorst , W. Ebeling, D. Martens, C. Nachtigall, K. North, P. Friedrich en A. Lantz (2006) Metakompetenzen und Kompetenzentwicklung (Metacompetencies and skill development), *QUEM-report Schriften zur beruflichen Weiterbildung Heft 95*/Teil I. Berlin, april 2006.

Friedman T.L. (2005), The World Is Flat: A Brief History of the Twenty-first Century, *Farrar, Straus & Giroux*, April 2005

Gorp, D.M. van (2010). Offshoring by manufacturing and service firms in the Netherlands Offshoring behavior in times of a financial crisis, *Nyenrode Business Universiteit*, March 2010
Grossman, G. and G. Maggi (2000), Diversity and trade, *American Economic Review*, 90 (5), 1255-1275

Grossman, G.M. and E. Rossi-Hansberg (2006). The rise of Offshoring: It's Not Wine for Cloth Anymore. Paper prepared for the symposium sponsored by the *Federal Reserve Bank of Kansas City*. July 2006.

Grossman, G.M. and E. Rossi-Hansberg (2008), Trading tasks: a simple theory of offshoring', *American Economic Review*, **98** (5)*,* 1978–1997.

Ligthart P.E.M., P. Vaessen en B. Dankbaar (2008) Innovatie van Productie. Onderzoeksrapportage van de European Manufacturing Survey (EMS) in de Nederlandse Maakindustrie (Innovation and Production. Research report of the European Manufacturing

Survey EMS in the Dutch Manufacturing industry), *Radboud Universiteit, Nijmegen, in cooperation with the Rabobank.*

Ménard, C. and M.M. Shirley (2005), Handbook of New Institutional Economics, *New York: Springer.*

Moser, C., Urban, D. and B. Weder di Mauro (2009). Offshoring, Firm Performance and Establishment-level Employment: Identifying Productivity and Downsizing Effects, *CEPR Discussion Paper Series*, No. 7455.

North, D.C. (1990), Institutions, Institutional Change and Economic Performance, Cambridge, MA: *Cambridge University Press*.

Oh, L. (2005) Offshoring: hype of succes. (Offshoring: hype or success) *Tijdschrift Controlling* (12), 22-26. December 2005.

Roe, R.A. (2002), Competenties. Een sleutel tot integratie in theorie en praktijk van de A&O-psychologie (Competencies. A key to integration in theory and practice of the labour and organisational psychology), *Gedrag & Organisatie 2002-15*, nr. 4 pagina 203-224

Trefler, D. (1995), The case of missing trade and other mysteries, *American Economic Review*, **85** (5), 1029–1046.

Volberda, H.W. , F.A.J. van den Bosch, J.J.P. Jansen, A. Szczygielska en M.W. Roza (2007) Inspelen op globalisering. Offshoring, innovatie en versterking van de concurrentiekracht van Nederland (Responding to globalisation. Offshoring, innovation and strengthening Dutch competitiveness), *SMO*, 2007-3

Wallis J.J. and D. C. North (1988), Measuring the transaction sector in the American Economy, 1870-1970., in S. L. Engerman and Robert E. Gallman, Long-Term Factors in American Economic Growth, *National Bureau of Economic Research*, Inc, 95-162.

Williamson, O.E. (1975), Markets and Hierarchies: Analysis and Antitrust Implications*, New York: Free Press.*

Williamson, O.E. (1996), *The Mechanisms of Governance.* New York: Oxford University Press.

Williamson, O.E., (1998), Transaction cost economics: How it works; Where it is headed, *De Economist*, 146, pp. 23-58.

Williamson, O.E., (2000), The new institutional economics: Taking stock, looking ahead, *Journal of Economic Literature,* 38, pp. 595-613.